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Research Issues in Child Health and Child Care

Proceedings of a workshop
held in Accra, Ghana,
22–26 September 1986

Proceedings

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Research Issues in Child Health and Child Care

Proceedings of a workshop held in Accra, Ghana, 22–26 September 1986

Editor: Fiona Mackenzie
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Abstract

This workshop brought together West African health scientists and social scientists to discuss methodological and conceptual issues in the study of infant and child health and mortality, and to identify new research needs. Health and social scientists from the Gambia, Ghana, Nigeria, and Sierra Leone attended the workshop. Emphasis was placed on evaluation of research design and procedures for analyzing the determinants of child health rather than on the presentation of findings. Discussions and papers focused on four central themes: conceptual frameworks more appropriate to local contexts, questions of scale and measurement, the search for indicators of child health, and directions for future interdisciplinary research. This publication is intended to serve as a record of the proceedings of the workshop and to promote further communication and interaction among researchers working in the area of infant and child mortality and health.

Résumé

Cet atelier réunissait des spécialistes de la santé et des sciences sociales de l'Afrique occidentale qui ont discuté de problèmes méthodologiques et conceptuels liés à l'étude de la santé et de la mortalité du nouveau-né et de l'enfant, et qui ont cerné de nouveaux besoins en matière de recherche. Des spécialistes des sciences de la santé et des sciences sociales de la Gambie, du Ghana, du Nigéria et de la Sierra Leone y participaient. On a mis l'accent sur l'évaluation de la conception de la recherche et sur les procédures d'analyse des déterminants de la santé des enfants, plutôt que sur la présentation des conclusions de travaux de recherche. Les discussions et les communications ont porté sur quatre grands thèmes : paramètres conceptuels mieux adaptés au contexte local, questions d'envergure, la recherche d'indicateurs de la santé des enfants et les orientations futures de la recherche interdisciplinaire. Cette publication a pour objet de faire le compte rendu des délibérations et en même temps de promouvoir la communication et les interactions entre les chercheurs dans le domaine de la mortalité et de la santé des nouveau-nés et des enfants.

Resumen

Este taller reunió a científicos del campo de la salud y las ciencias sociales para discutir cuestiones conceptuales y metodológicas en el estudio de la salud y mortalidad infantiles y para identificar nuevas necesidades investigativas. Asistieron al taller científicos de la salud y las ciencias sociales de Gambia, Ghana, Nigeria y Sierra Leona. Se hizo más énfasis en la evaluación del diseño y los procedimientos investigativos para analizar los determinantes de la salud infantil que en la presentación de los resultados. Las discusiones y documentos se centraron en cuatro temas: marcos de trabajo conceptuales más apropiados para los entornos locales, cuestiones de escala y medición, búsqueda de indicadores de salud infantil y pautas para la investigación interdisciplinaria futura. El propósito de esta publicación es el de registrar las sesiones del taller y promover una mayor comunicación e interacción entre los investigadores que trabajan en el campo de la salud y mortalidad infantiles.

CONTENTS

Foreword vii

Introduction 1

Keynote address: Infant and child mortality and morbidity: reflections on theoretical and methodological issues
Diana Oya Sawyer 3

Conceptual framework for the study of child health and child care
K. Venkatacharya and **Tesfay Teklu** 11

Socioeconomic determinants of child health in Ghana
Patrick A. Twumasi 26

Methodological and operational problems in the collection of data on infant and child mortality **Rebecca Appiah** 40

Child health and child care in Pelotas, Southern Brazil: methodology and results of a longitudinal study
Fernando C. Barros, Cesar G. Victora, and J. Patrick Vaughan 48

Issues in an examination of the relationship between maternal education and child mortality **Bamikale J. Feyisetan** 66

Measuring child mortality from maternity histories collected at time of childbirth: the EMIS surveys
Cheikh S.M. Mbacké 77

Research Proposals and Preliminary Findings 95

- Operations research and MCH/FP health care delivery
  Charlotte N. Gardiner 96

- An alternative approach to vital events registration in Ghana: the Suhum experience **G.A. Ashitey** and **A.O.C. Nettey-Marbell** 97

- Survey of correlates of mortality in Sierra Leone
  H.B.S. Kandeh 98

- Culture and health: lessons from data collection on child health in Ghana **S.R. Ubomba-Jaswa** 100

- Infant mortality and second-year death rates in the Gambia, 1973 and 1983, and a vaccination compliance survey
  M. Yamuah 101

Infant and child mortality, environmental factors, and the socioeconomic status of women in two rural centres in the western part of Nigeria: a research proposal **Folsade Iyun** 102

The determinants of infant and child health and survival in Sierra Leone: a research proposal **Fatu Yumkella** 104

Infant and child health in the Gambia: overview of a research proposal **M.S. Jeng** and **M. Yamush** 104

Population, food production, and nutrition in a northern savannah village of Ghana **G. Benneh** 105

Population, health, and nutrition in Upper East Region, Ghana, with special reference to child health and child care **G. Benneh, R. Orraca-Tetteh, P.A. Twumasi,** and **J.S. Nabila** 106

Summary and Reflections **Fiona Mackenzie** 108

Participants 115

Observers 117

FOREWORD

The need for interdisciplinary research on the persistent problems of high infant and child mortality and poor health in many developing countries has been widely recognized. Although initial reductions in infant deaths, which account for 40% or more of all deaths in developing countries, can often be achieved through health technology, it is now widely recognized that sustained reductions in infant mortality can be achieved more effectively through programs that address the biomedical, socioeconomic, cultural, and environmental determinants of infant mortality. The design and successful implementation of programs that address these determinants require the collaborative efforts of researchers from various disciplines including health scientists, nutritionists, social scientists, demographers, and educators.

The Population, Health, and Development (PHD) project of the Social Sciences Division of IDRC was initiated in 1983 as a temporary mechanism to support developing country researchers carrying out interdisciplinary investigations of high levels of infant and child mortality and poor health. To this end, and with the active involvement of the Health Sciences Division, the project has organized a series of workshops for health scientists and social scientists active in child health research, prepared two large research bibliographies, sponsored several researchers to international conferences, and commissioned a series of technical research papers on widely recognized problems or gaps in infant mortality research.

To provide support for the emerging area of interdisciplinary research and to bring together West African health scientists and social scientists for the discussion of methodological and conceptual issues in the study of infant mortality and health and its determinants, the Institute of Statistical, Social and Economic Research (ISSER), the United Nations Regional Institute for Population Studies (RIPS), and the International Development Research Centre (IDRC) jointly organized the Workshop on Research Issues in Child Health and Child Care, in Accra, Ghana (September 1986). The workshop emphasized the evaluation of research design and procedures rather than the analysis and presentation of findings. Papers and discussions focused on four central themes: conceptual frameworks for interdisciplinary research appropriate to local contexts, questions of scale and of measurement, the search for health and mortality indicators, and directions for future research on child health.

It is hoped that the following papers and discussion from the Workshop on Research Issues in Child Health and Child Care will encourage further interdisciplinary research on infant and child health and mortality. The PHD project-IDRC wishes to express its gratitude to ISSER, RIPS, the Organizing Committee and, in particular, to Professor K. Ewusi, the chair of the Organizing Committee. Without their hard work, a successful workshop would not have been possible.

Sandra Witt
Coordinator
Population, Health, and Development Project
International Development Research Centre

INTRODUCTION

In recognition of the continuing fragmented nature of research in the field of infant and child health and mortality in Africa, the workshop on Research Issues in Child Health and Child Care was organized to facilitate the exchange of researcher experiences of West African researchers working in this field and to identify new ideas and research needs. A further general objective was to link research priorities and design with policy recommendations. It was intended to examine research experiences with reference to their implications for public health interventions, particularly primary health care (PHC). More specifically, through the exchange of ideas among demographers, social scientists, and health scientists, the workshop aimed to centre discussion on conceptual and methodological issues which arise as research seeks to develop a more comprehensive understanding of the complex interrelationships which influence child health and mortality through the integration of social and biomedical perspectives in research and design analysis. A major concern was to discuss conceptual frameworks more appropriate to the African context for the analysis of the determinants of child health and to examine methodological problems which result from the design of studies sensitive to local situations.

Participants were drawn from a wide variety of disciplines and from different levels of experience and expertise. Twenty participants, from the Gambia, Ghana, Nigeria, and Sierra Leone, included health and social scientists employed in government health ministeries and departments of statistics and demographers, geographers, nutritionists, sociologists, and community health faculty from university departments. All had played a major role in defining the objectives and nature of the workshop. A demographer from the Institut du Sahel, who had participated in an IDRC-sponsored workshop in Bamako, Mali, and two researchers from Brazil (a demographer and an obstetrician), who had attended a parallel workshop in Latin America, were invited as resource people with the idea of encouraging a south-south interchange of research experience.

To facilitate discussion, participants were requested to bring to the workshop a brief paper outlining their current research interests and detailing conceptual and methodological issues or problems they faced in this context. During the workshop, emphasis was placed on the evaluation of research design and procedures rather than on analysis of findings. For the most part, these working papers appeared in summary form in this volume (see Research Proposals and Preliminary Findings). Following the keynote address by Diana Sawyer, three papers commissioned as background documents (Venkatacharya and Tesfay Teklu, Twumasi and Barros, Victora and Vaughan) appear with three of the more detailed and comprehensive papers submitted by other workshop participants. In the final section, the central issues of debate at the workshop are summarized and discussed with reference to key conceptual and methodological concerns in the research field.

The workshop was organized by a committee with representatives from the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana; the U.N. Regional Institute for Population Studies (RIPS); and IDRC. As Director of the host institution, ISSER, and Chair of the Organizing Committee, Professor Ewusi had responsibility for logistical and administrative arrangements of the workshop in liaison with Sandra Witt of IDRC. The University of Ghana supported the workshop through the offices of the Pro-Vice Chancellor, Professor Beneh.

This joint IDRC/ISSER publication is intended both as a record of the proceedings of the workshop and to facilitate further communication among researchers working in the field.

INFANT AND CHILD MORTALITY AND MORBIDITY: REFLECTIONS ON THEORETICAL AND METHODOLOGICAL ISSUES

Keynote Address

Diana Oya Sawyer

First of all, I would like to thank the organizers of this workshop for inviting me. It is indeed an honor to give a keynote address. I must admit that it involves more responsibility than I realized when I accepted the invitation. I was enthusiastic about getting to know Africa, and I have participated in other seminars and workshops on infant and child mortality. On those occasions, I never found it very difficult to comment on what others have said. I now see that it is quite different to be the first one to speak on a subject. Because it is too late now for me to have second thoughts and change my mind, I will do my best to at least provoke discussion. I have also had "third thoughts" and am convinced that Africa and South America have much in common with regard to infant and child health and that we have much to learn from each other. We at the Centre for Regional Planning and Development (CEDEPLAR) have recognized this in our new masters and doctoral program in Demography, in which we train students from Brazil, Portuguese-speaking Africa, and other countries.

At CEDEPLAR, I work with demography, especially mortality. Because of its importance in developing countries such as Brazil, I study primarily infant and child mortality. Although I consider the understanding of health and morbidity a necessity for understanding mortality, and have done extensive research in the last few years on economic and social aspects of one type of morbidity (malaria), most of my experience relates to mortality. Therefore, most of my comments centre on mortality rather than on morbidity. As I hope to make clear by the end of my talk, I feel that the study of health and morbidity can gain from the lessons learned in the study of mortality and of the other demographic variables - fertility and migration. So, it is not accidental that I place more emphasis on demography than on epidemiology.

The progress that has been achieved in knowledge about levels, trends, and differentials of mortality and its determinants in developing countries is due to successive advances in measurement techniques and to the contributions of professionals from different backgrounds. We have learned a great deal about how to quantify mortality patterns and the socioeconomic, demographic, and environmental factors associated with them in different situations, even where data are deficient. Nevertheless, measurement techniques are not consistent and approaches are still segmented, making it difficult to arrive at explanations that are organically integrated or that combine quantitative and qualitative approaches.

It is as if we had before us an unfinished jigsaw puzzle. We have many pieces on the table, but have not been able to put them all together. We do not know what the final picture looks like, or even if we have too few or too many pieces. To make matters worse, the pieces are made by different manufacturers, without uniform standards.

I do not intend to set standards, count pieces, or provide the overall frame for this jigsaw puzzle. I do not know what the final picture will be, or where it ends and other pictures start. In a more modest way, I shall provide some comments and questions regarding the progress that has been made and on the holes that seem to remain.

Although my background and experience are primarily Latin American, most of the issues I raise are universal, and others apply equally to Africa and other parts of the world where infant and child mortality and morbidity are so much higher than in developed countries that this fact in itself is one of the best indicators of differences in levels of development.

Measurement

Conceptually, measures of mortality and morbidity usually refer to the frequency of certain occurrences - death or disease - to which a population at risk is subject during a given period. Death, like birth, is an event that occurs only once. Disease, on the other hand, is a state, which at the extreme may last an entire lifetime. Demography and epidemiology distinguish between incidence, which refers to new cases occurring in a given period, and prevalence, which refers to the number of cases existing at a given time. Incidence is a measure of flow and prevalence is a measure of stock.

Measures of mortality and morbidity depend on both the nature and quality of the data on the events or cases. It is less obvious but equally important that they also depend on data on the population in question. My comments focus primarily on the numerator, but I stress that the population denominator is an essential part of any rate, and that accurate estimates for particular age groups, localities, or socioeconomic categories are not easy to come by, especially in developing countries.

Estimates of mortality, as of fertility and migration, are of two types, direct and indirect. Direct demographic estimates are obtained when rates are calculated by relating the number of events to the population at risk. In developing countries, data on the events and the population or both are not always available. In such a situation, indirect estimates may be obtained by observing some related parameters using reliable and cheaper procedures and deriving the necessary measures by applying adequate models.

I would like to start by pointing out some of the main methodological issues involved in making and using direct and indirect estimates of mortality. Many of the issues also apply to morbidity.

Direct Estimates

Direct estimates of mortality are ordinarily based on vital statistics from civil registration systems, i.e., death certificates.

Measurements of morbidity are usually direct in that they refer to cases themselves, at one point or period in time. They differ - a difference shared with mortality and fertility estimates - in terms of certified vs. self-reported information. Morbidity statistics may be similar to vital statistics in that they depend on certification by some medical or other authority, as with notification, hospital records, or causes of death on death certificates. On the other hand, morbidity statistics may not be based on registration, but rather on individual responses to survey or census questions, i.e., self-reporting, with or without medical confirmation.

The main sources of direct data on mortality and morbidity are registration systems and sample surveys, each of which presents particular problems and prospects.

Registration Systems

Measurements based on continuous registration of mortality or morbidity have the advantage of availability for whatever points in space or time the researcher may choose. They can be disaggregated by year, season, or locality. There are serious drawbacks, however, especially in developing countries.

Coverage

Mortality statistics in developing countries suffer from notorious problems of underreporting. One cannot normally draw conclusions about mortality levels, and it is very risky indeed to speak about trends and differentials, which are sensitive to differences in coverage. Other errors are due to mobility of individuals, so that place of occurrence or registration is different from place of residence. Obviously, the problems of coverage are even more serious for morbidity than for mortality.

Quality

Although, for all practical purposes, the quality of the information on the death itself is perfect, the other information on the death certificate usually leaves much to be desired. The most serious problems arise with information on occupation (of parents) and cause of death, which are important for studying morbidity and interpreting determinants. The number of possible categories is great and the criteria and terminology used by those filling out the forms are not uniform. Considerable progress has been made in the uniform classification of diseases but, in many areas, there are no qualified personnel to apply the classification scheme, and the proportion of poorly defined causes is great.

Identification of Population at Risk

Even if coverage and quality of registration of mortality or morbidity were perfect, estimating the population at risk is still a problem, particulary analyzing social and economic characteristics, data on which must come from other sources, usually the census. Census data are generally too old and the categories used are often different from the registration system.

These disadvantages do not mean that registration systems are worthless. Our first task is to discover the deficiencies, take them into account and then improve registration so that we do not depend on deficient data and temporary substitutes.

Sample Surveys

Well-conducted sample surveys can overcome the problems of coverage, quality, and identification of the population at risk that are inherent in registration systems. They also provide data in the appropriate form and permit greater depth of analysis. Although demographers do not all agree that surveys provide "direct" estimates, they will be considered so for present purposes.

Retrospective surveys, which are unavoidable for mortality and for all but the most common morbidities, face problems of selective recall and reference period errors. Multiround surveys can diminish these problems, but their high cost and attrition prevent wide use.

Surveys of mortality and morbidity are different from surveys dealing with questions such as voter preference in that they seek events that are relatively rare. Even if fertility and infant mortality are high, infant deaths are not common. For example, for a crude birth rate of 40 and infant mortality rate of 200, there would be only 8 infant deaths in 1 year per 1000 population. There are many possible diseases. This means that sample size for mortality and morbidity surveys with short reference periods has to be very large, especially if one seeks to establish differentials or to conduct multivariate analysis.

Retrospective data on number and timing of births and deaths, combined with cohort analysis and life-table techniques, offer an interesting alternative (Cox 1972). They permit smaller sample size, and life-table techniques avoid problems of censure.

Use of proportional risks, which involves combination of life tables and multiple regression, opens broad horizons for analysis of reproductive histories and social and economic covariates of mortality (Gomez 1982). Similar approaches are used to study morbidity.

Sample surveys can be combined with studies based on civil registration. In the investigation of mortality in childhood conducted by the Pan American Health Organization - a classic example that attests to the results that can be achieved - death certificates were sampled and attending physicians were interviewed, providing much more precise information on causes of death (Puffer and Serrano 1973). One problem of this approach is that it only includes cases of death, so that rates and differentials cannot be established.

Indirect Estimates of Mortality

Because of deficiencies in civil registration systems and the limitations of sample surveys, indirect estimates of mortality must usually be used in developing countries. The most widely used indirect estimation techniques for fertility and mortality were developed about 20 years ago by William Brass et al. (1968) in The Demography of Tropical Africa. The basic idea in the case of mortality is to estimate levels using data on the proportion of surviving children among mothers of different ages, as reported by the mothers themselves in response to census or survey questions. In spite of initial doubts about their assumptions and the quality of census reporting, they have provided robust indicators of differentials.

Although indirect techniques do not exist for morbidity, lessons may be learned from the experience that demographers have gained with mortality. The source of information for indirect estimates of infant mortality is the same for the numerator and denominator. Thus, there the population at risk can be estimated. Because indirect estimates of infant mortality refer to the entire reproductive histories of the women interviewed, not just to a short reference period, sample size can be relatively small.

One of the main problems with indirect estimates of mortality is that the deaths may have occurred in the distant past, whereas socioeconomic correlates are observed at the time of the interview or census. This problem is reduced by using data on young mothers, for which the time lapse, by definition, cannot be great. Because variables such as education and income are often correlated with age, however, it may be more appropriate from the socioeconomic point of view to study older mothers.

Other problems, not restricted to indirect estimates, have to do with time of exposure to risk, which may be related to the independent variables and lead to false conclusions. For example, women who work may seem to have lower infant mortality simply because they married later and had their children later than nonworking mothers. Also, different composition by categories of the independent variables complicates comparisons among different periods or regions. To the extent that these problems are known, adjustments can be made.

Differentials

Although differentials do not explain determinants of mortality or morbidity, they are a first approximation, as well as providing useful indicators of the groups at greatest risk, for purposes of intervention. Problems arise when causality is attributed to the socioeconomic or environmental variables.

Various biological differentials in infant mortality are well known: age of mother, spacing, birth order, gender, weight at birth, etc. The extent to which such differentials are actually due to biological rather than socioeconomic factors has been a subject of study (e.g., Heady et al. 1955, Geronimus 1986). Nonbiological differentials have to do with socioeconomic conditions, environment, access to health services, and culture. In developing countries, mothers' education stands out as a variable that produces strong differentials, although it is not clear to what extent mothers' education acts in and of itself to reduce mortality, as opposed to being an easily accessible and stable indicator of less easily observed socioeconomic conditions.

One immediate methodological problem with differentials is that the magnitude of the differentials depends on the number of categories used and the cut-off points, making comparisons difficult. Although uniformity may be desirable for purposes of comparison, definition of variables and categories should be appropriate for the particular socioeconomic settings and populations being studied. The magnitude of the differentials also depends on the overall level of mortality, which may influence the relative weight of biological and socioeconomic variables (Gomez 1982).

Recent developments in indirect estimation procedures make it possible to obtain differentials not only in mortality levels but also in trends. The problem with these procedures is not so much the estimates themselves as the socioeconomic classifications used. If they are based on permeable groups, estimated trends may be affected as the composition of the groups varies (Fernandez Castilla 1985).

Researchers using mortality differentials often do not take into account the effects of other variables with simultaneous effects. Although it is clear that infant mortality is highest where living conditions are worst, isolated differentials do not permit assessment of the additive and interactive effects of the variables and are not appropriate for orientation of policy.

Multivariate analyses can elucidate the effects of different variables. However, these are inconclusive if done out of context. One survey of multivariate analyses done in the Third World found that the only variable that was consistently important was the child's gender (Sullivan et al. 1982). The effects of other variables varied considerably. One of my own studies in Brazil indicated that the effects of variables depend on the particular regional context (Sawyer and Soares 1983).

The general conclusion seems to be that analyses of determinants or intervening factors in infant and child mortality, and by extension of morbidity as well, even if they are carried out with the best available multivariate methodology, will be inconclusive and not very useful unless they refer to the concrete societies in which they operate. Factors are empirical manifestations of social relations existing in these societies. Unless these relations are understood, the variables will have little true explanatory power.

Interdisciplinary Research

The apparently contradictory results suggest that the search for "the most important variable" for explaining infant mortality is futile. Relations among variables should be studied in accordance with a well-defined conceptual framework constructed in accordance with the relations existing in specific societies or settings. This does not mean that studies to date did not have conceptual frameworks. They may have had interesting frameworks, but relied on secondary, partial, or nonspecific data that were not appropriate for the framework.

Mosley and Chen (1983:41) commented on the policy implications of this situation:

> In this sense, health action research projects implemented without a broader conceptual framework too often become self-fulfilling prophecies. Since most interventions, particularly with powerful modern technologies, are likely to have some measurable effect and since all other variables have been "controlled" by the research design, the policy maker is led to adopt the preconceived strategy, unaware that alternative possibilities were rejected a priori.

The present tendency is to recognize humans as biosocial. The biological substrate is worn down or consumed with varying intensity and rhythm in accordance with its interaction with the social and physical environment. The conceptual framework for understanding the process of health-disease-death needs to be broad enough to incorporate the biological and social interactions. Unfortunately, the production of knowledge is still extremely segmented. We learn increasingly more about parts of the biological or social person, but little about people as biosocial beings.

"Interdisciplinary" research has attracted much attention. But what does "interdisciplinary" mean? How can such research be put into practice? Some researchers who have tried it are pessimistic, saying that it is very time-consuming and even nerve-wracking. Others grant that it is time-consuming but are gratified, if not by the research results, at least by seeing what other disciplines have to say.

Interdisciplinary research is sometimes criticized for producing reports in which there is a series of chapters, each written by a specialist, but unconnected to the other chapters. At the other extreme, there are one-person interdisciplinary "teams," i.e., an individual who knows a little about a lot of fields, but masters none.

Fragmented training, together with the prestige of certain disciplines, makes interdisciplinary research problematic, especially because interpersonal relationships are involved. I think that interdisciplinary research is neither the sum of different approaches nor the broadening of one specific theory. It requires organic integration of already existing methodologies and approaches. Some prefer the term "multidisciplinary." Integration begins at the level of the conceptual framework, is embodied during the research process, and is consolidated in the final product. It cannot be accomplished without good will and recognition that there is no single theory or approach capable of identifying and making comprehensible a process as complicated as health-disease-death.

From this point of view, there is no need for a new theory that is an amalgam of diverse specific methodologies or for a new field of knowledge. Interdisciplinary or multidisciplinary research begins with the professional competence of researcher in their respective discipline. The contribution of each in putting the jigsaw puzzle together, however small the piece may be, is important in the final picture. Each participant must be willing to accept the contributions of others and refrain from imposing the theories and methodologies of their own discipline.

In the case of research on mortality and morbidity, the problem is not just to measure differentials by occupation, income, or education, but to understand why in a particular society or setting the differentials behave as they do. This requires that various specialists work together in an atmosphere of respect for their areas of competence and, most of all, respect for the human beings they are studying.

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CONCEPTUAL FRAMEWORK FOR THE STUDY OF CHILD HEALTH AND CHILD CARE

K. Venkatacharya and Tesfay Teklu [1]

Introduction

The provision of means to achieve health for all by the year 2000 and maintaining it thereafter is a laudable goal toward which all developing countries must strive. A particular concern is maintaining reasonable health for children under 5 years owing to the high mortality and morbidity of this age group. Yet, the task is difficult in view of the many socioeconomic and political problems that beset a developing country.

Health and morbidity or mortality are inversely related. Because high mortality of infants and children was prevalent in the early 1960s, attention was focused on reducing mortality. The vertical health interventions through mass immunization and medical therapy produced the initial breakthrough in the control of mortality without any significant increase in living standards or nutritional improvements. The use of powerful insecticides, mass vaccination, and antibiotics has been very effective. The major infectious diseases such as malaria, smallpox, measles, and cholera that accounted for the majority of deaths have been brought under control and smallpox is eradicated. Many countries in the developing world that passed through this phase have failed to record further declines and in some cases signs of an upward trend are noticed. Success stories include Sri Lanka, the Republic of China, and the State of Kerala in India. Emerging opinion attributes the various degrees of success to a number of causes including lack of socioeconomic development and improvements in living standards.

The success or failure of a particular program in the field of health or family planning can be explained in terms of three elements: appropriate technology, efficient delivery systems, and social acceptance and motivation.

Technology development is the concern of biomedical experts who develop techniques to reduce morbidity under clinical conditions. The task of adopting these technologies, sometimes with modifications to suit field conditions, is a management problem. Public, governmental, and nongovernmental support are needed for this. The political will of the nation is a determining factor. The last, and most important, element is the acceptance of the technology by the population.

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[1] The views expressed in this paper are those of the authors and do not necessarily reflect those of the United Nations or the Regional Institute for Population Studies.

It is also critically significant to develop a conceptual framework that informs the design of such health or family planning programs. In the past, the partial analysis of demographic phenomena has been a limiting factor in the development of adequate programs. The efforts of merging Maternal and Child Health (MCH) and Family Planning Programs have paid dividends in many developing countries. Now there is a need to integrate MCH, Family Planning, and Rural Development Programs into one single intervention. UNICEF is promoting a "child survival revolution" based on an approach that integrates growth monitoring, oral rehydration, breastfeeding, immunization, food supplements, and family planning (GOBI-FF).

To policymakers as well as scientists, the need to determine factors that affect health, morbidity, and mortality of a population is well recognized. Understanding the determinants of the life process or, specifically, mortality and health will help determine the nature of the intervention, the appropriate point in the life process at which such an intervention is effective, and the background preparation necessary for such an intervention. It will also assist in the evaluation of a particular program.

The objective of this paper is to develop a framework within which the health and mortality of children under 5 years of age may be studied. It draws heavily on research in the field of fertility, and particularly on the concept of proximate determinants. This concept has led to important insights in the analysis of fertility. Development of such a framework is expected to increase our understanding of the mechanisms underlying mortality and health. In this paper, we are concerned with the health and mortality issues of children under 5 years.

Two approaches to the use of proximate determinants are illustrated in the recent discussions of conceptual frameworks for the study of child health and mortality (Mosley 1985; Venkatacharya 1985). The core themes are similar; differences lie at the operational stage.

In the proximate determinants framework of Mosley (1985), nine variables of fertility and mortality are integrated under four main categories. These are shown below:

I Conception exposure factors
    (1) Sexual union
    (2) Intercourse frequency
II Lactation factor
    (3) Breast feeding
III Ecological risk factors
    (4) Dietary deficiency
    (5) Environmental contamination
    (6) Accidents
IV Direct interventions
    (7) Personal prevention measures
    (8) Curative measures
    (9) Intentional injury

Most of these variables are easily measurable and studies based on single-round surveys can provide the data required for the analysis.

A second approach, with a biomedical bias, is suggested by Venkatacharya (1985) to examine health and mortality as a life process from birth to death of a child. The proximate determinants of mortality are not always fixed for all situations. Further, there is a chain causation and the ultimate cause of mortality is difficult to determine. An attempt is made to illustrate the spectrum of causes of mortality (Fig. 1). Mosley's general framework of proximate determinants is illustrated in Fig. 2.

One pertinent question related to the development of an efficient framework for the study of the child health and mortality is the gap between such knowledge and our ability to put it into effective use. There is no doubt about the importance of safe drinking water, better toilets, and immunization in reducing child morbidity and mortality. Despite this knowledge, interventions based on this knowledge have not succeeded in reducing child morbidity and mortality to the levels theoretically expected. There is thus the need to bridge the gap between knowledge and effective implementation, and to analyze socioeconomic as well as biomedical variables.

Before we proceed to a discussion of how we can implement these models, a brief review of the determinants of infant and child health and mortality will be useful. In presenting the findings of many studies done in this area, the scheme shown in Fig. 1 is followed.

Review of Determinants of Infant and Child Health

Healthy State

The WHO definition of health, i.e., "Health is a state of complete physical, mental and social well-being, and not merely an absence of disease and infirmity," is an ambitious one. In many countries, even the mere achievement of physical health and absence of disease is a laudable goal. The problems of defining health are well recognized. In most developing countries, the closest approximation to the measurement of health is indirect and is gained from the study of the incidence of disease and causes of death. These data are scarce or unreliable. At the individual level, there is no satisfactory index of health. In most cases, the health of an individual is the balance between the host, the disease agent, and the environment. Various factors disturb the health equilibrium leading to morbidity and death.

The survival of a child in the 1st and subsequent weeks depends on a number of biological, socioeconomic, and cultural factors. The factors that influence the survival of the child in the 1st week are more dependent on the "gestational environment" of the mother and, to a lesser extent, on the "birth environment" of the child. The health of the mother, which includes the nutritional status during pregnancy, is a particularly important determinant. For instance, inoculation of mothers against neonatal tetanus in areas where tetanus is a major cause of death reduced infant and child mortality considerably (Smucker et al. 1980). Maternal and child health programs with nutritional components have contributed greatly to the births of healthy children. In fact, birth-weight-for-gestation-age (or simply birth weight) is found to be the major determinant of child survival in the early stages (Davanzo et al. 1983).

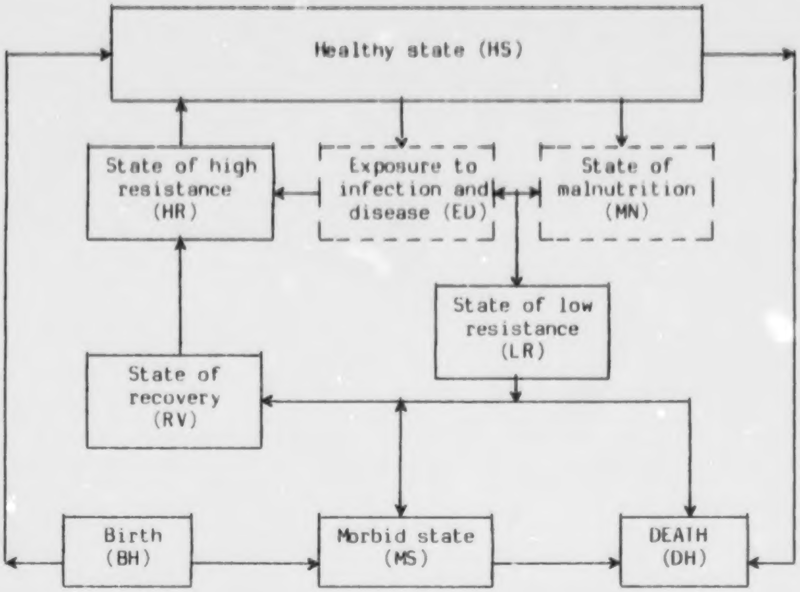
Healthy state (HS)
State of high resistance (HR)
Exposure to infection and disease (ED)
State of malnutrition (MN)
State of low resistance (LR)
State of recovery (RV)
Birth (BH)
Morbid state (MS)
DEATH (DH)

Fig. 1 **Process from birth to death among children (Venkatacharya 1985:239).**

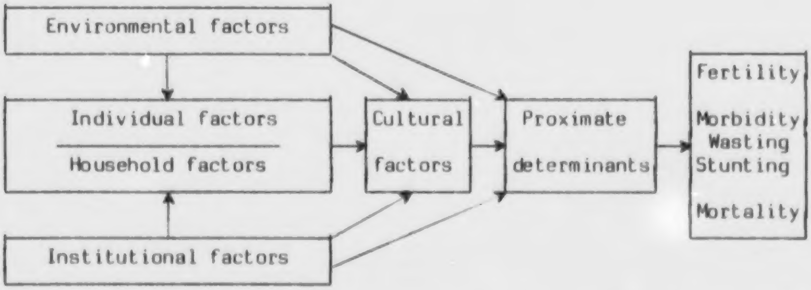

Fig. 2. General model of the interrelationships of underlying and proximate determinants to fertility and child survival (Mosley 1985:197).

Sex differentials in infant and child mortality are also well documented. Male mortality in the neonatal and postneonatal periods is found to be higher than that for females in most of the countries of the world. Behavioural factors such as preference for male children in feeding and health care are advanced as causes for higher female mortality in the childhood ages for some South Asian countries (Nadarajah 1983).

Table 1. Factors that affect transition from one state of health to another.

Transition type	More proximate variables	Proximate variables	Less proximate or remote variables
Birth to healthy state	Birth weight Sex Gestational age Genetic endowment Ethnicity/race Maternal nutritional status during pregnancy Maternal health Mothers age and/or parity Birth practices Pregnancy spacing	Education of mother Education of father Standard of living of the household Marital status of mother	National level of socioeconomic development (national income) Religion Geography and physical environment Mother's childhood residence Level and spread of MCH, nutritional and family planning interventions Literarcy of population Level and spread of public health services
Birth to morbid state	Low birth weight Sex (female) Low gestational age Poor maternal nutrition during pregnancy Poor maternal health Low age and/or first parity; and high parity and age of mother Poor birth practices/injuries Poor genetic endowment Ethnicity/race	Low education of mother Low education of father Low standard of living of household Marital status (unmarried)	Same as above

continued

Table 1. Continued.

Transition type	More proximate variables	Proximate variables	Less proximate or remote variables
Health state to state of malnutrition	Short preceding (and/or succeeding) birth interval Early weaning and/or inappropriate infant foods Delayed, inadequate and/or inappropriate infant foods Higher age and/or parity of mother Sex preference in feeding	Low household income and standard of living Attitudes and tastes of food High fertility, crowding, sibling competition Child rearing practices Behaviour related to child feeding Education of the mother	National level of socioeconomic development (national income) Food production and special programs on nutrition and dietary supplements Literacy of population Rural/urban residence
Health state to exposure to infection	Household hygiene Type of household water supply Lack of good toilet Early or too late weaning and/or inappropriate feeding Poor sanitary conditions of baby feeding Prevalence of disease around household Level of child immunization Genetic endowment Ethnicity/race Injuries	Mother's education Father's education Community sanitation High fertility and crowding conditions Household income (Household standard of living)	National leavel of socioeconomic development (national income) Migration during wars and famines Availability of health care Level of preventive programs for disease

continued

Table 1. Continued.

Transition type	More proximate variables	Proximate variables	Less proximate or remote variables
Exposure to disease and malnutrition to low resistance	Level of malnutrition Poor medical care Short birth interval and/or short duration of breast feeding Genetic endowment Ethnicity/race Injuries	Household income Standard of living Poor maternal care Mother's education Father's education	National level of socioeconomic development (national income) Level and spread of MCH, nutritional and family planning interventions Level and spread of public health and medical care Literacy level
Low resistance to morbid state	Lack of initiative to avail medical care Poor nutrition Medical care not accessible	Mother's education Father's education Household income	National level of socioeconomic development (national income) Level and spread of MCH, nutritional and family planning interventions Literacy level
Morbid state or low resistance state to recovery state	Access to medical care care Proper nutrition	Mother's education Father's education Household income (standard of living)	National level of socioeconomic development (national income) Level and spread of MCH, nutritional and family planning intervention Literacy of population

The health of a child in the initial stages of life is also found to vary by age (proxy for biological age) and parity of the mother. Children born to young mothers, under 18 years of age, have higher mortality risks owing largely to biological factors. First-parity children are found to have higher mortality as a result of low birth weight, whereas higher-parity children exhibit higher mortality as a result of behavioural factors (Davanzo et al. 1983).

Evidence is accumulating on the impact of short birth interval on infant and child mortality and morbidity (ICMM). The magnitude of the impact and its implications are not clear, however, mainly because the available data fail to account for confounding effects and many factors of relevance are not controlled. This is systematically argued in an interesting paper by Winikoff (1983). In societies where prolonged breastfeeding is a norm and birth intervals average 36 months, women experiencing short birth intervals (less than a year) will be a selective group. They may be women experiencing a high rate of premature births, children with low birth weight, or previous infant deaths. From the available data, it is difficult to isolate the "active component" of short birth interval that affects ICMM. What is possibly true is that very short birth intervals combined with low-birthweight-for-gestation will contribute to higher neonatal and postneonatal mortality. The "active component" of short birth interval that may have relevance to neonatal mortality is basically biological in nature, i.e., the nutritional depletion of the mother during pregnancy and lactation. In the case of postneonatal and infant mortality, the behavioural component of sibling competition and poor "mothering" could also be responsible.

The prevalence of breastfeeding during the 1st week after birth in most countries, especially developing countries, is found to confer bacterial and viral immunity against gastrointestinal infection (Winikoff 1983). This contributes to lower mortality under 6 months and, to some extent, lower mortality in the postneonatal stage. Together with birth weight, breastfeeding forms a major determinant of neonatal mortality. In the medical literature, the relevance of the standard level of birth weight of 2.5 kg in analyzing mortality in the developing world has been questioned.

Beyond the 1st week of the child's life, the importance of birth environment increases. Birth practices affect the outcome of delivery, that is, the survival chances of the newborn from such causes as neonatal tetanus (4-10 days after delivery). Premature births may be saved if trained birth attendants are present or the high-risk deliveries are done in hospitals. These factors contribute to lower neonatal and postneonatal mortality. In a study in India, neonatal mortality due to tetanus was found to claim 66% of all neonatal deaths. In fact, neonatal deaths themselves formed about 60% of infant deaths (Smucker et al. 1980). In Sri Lanka, also, neonatal mortality formed about 60% of infant mortality, but neonatal deaths due to tetanus accounted for only 1.7% (Meegama 1980). The presence of trained midwives or birth attendants and the use of sterile equipment to cut the umbilical cord and similar measures to improve sanitation were found to result in lower neonatal mortality.

Unfortunately, the current data and analysis have given relatively little importance to genetic factors, partly because of the difficulty of treating these factors. Even studies that may reflect these factors indirectly through ethnicity are few and far between (Davanzo et al. 1983; Mensch et al. 1983).

The above factors are more proximate to birth into a healthy state and continuance in that state during the period of infancy and childhood than other variables. There are, however, other important factors, behavioural, socioeconomic, and cultural, that can be treated as proximate variables. The most important variable that has emerged from cross-country comparisons is mothers' education (Caldwell 1979; Frenzen et al. 1982; Simmons and Bernstein 1982; and Mensch et al. 1983). Although higher levels of maternal education are found to lower mortality, the magnitude of the impact is not uniform (Palloni 1983). The mechanisms through which mothers' education affects ICMM are not clear nor are the relationships among maternal education, paternal education, and household socioeconomic characteristics. The "active component" of mothers' education that leads to lowering ICMM has great policy relevance, although in the absence of such knowledge, it is still worthwhile to advocate programs aimed at increasing female education. An increase in female education may reduce fertility (or increase the birth interval) which in turn tends to reduce mortality. Caldwell, who has pioneered work on this, believes that female education contributes greatly toward lower ICMM by a mother's ability to break with tradition or become less "fatalistic" about illness. She may also adopt alternative improved, child-care arrangements and play a larger role in family decision-making with respect to preventive and curative health care that benefits the child (Caldwell 1979; Caldwell et al. 1983).

If we move to the outer spheres of the individual family or household, we will find a number of less proximate variables or background variables that are found to influence indirectly the health of the child. Studies have established correlations or associations between variables such as national income, literacy, mother's childhood residence, parental education, and expenditure on health, and infant and child mortality (Preston and Nelson 1974; Rodgers 1979; Diaz-Briquets 1981; Flegg 1982; and Palloni 1983). Many of these variables are found to be related to mortality levels although the magnitude of the association varies between countries and over time for the same country. Although such studies help indicate the relevance of certain factors to mortality decline, by the nature of their analysis, they fail to provide useful information on the causation of ICMM.

State of Malnutrition

Increasing evidence is emerging on the salience of maternal and child nutrition in lowering ICMM (Scrimshaw et al. 1968; Winikoff 1983; and Edmonston and Martorell 1984). A high standard of maternal nutrition, especially during pregnancy, has great impact on lowering child mortality through the mediating effect of birth weight. After the birth of a child, especially during the weaning period, the nutrition of the child is of paramount importance (Winikoff 1980; Edmonston and Martorell 1984; Caldwell et al. 1983) as in most developing countries, children grow in an unsanitary environment and concomitantly suffer from malnutrition. The synergistic effects of these two on ICMM are far greater than the sum total of their individual effects. Malnutrition affects the immune responses of children which in turn renders them susceptible to infections. Children suffering from kwashiorkor have both cell-mediated and humoral immunity whereas, in marasmus, both these responses appear normal. The household economic level and high fertility of the mother influence both these factors.

The role of breastfeeding is very important in the postneonatal period. Mothers' milk not only provides complete nutritional requirements for the child in the first 6 months but also provides defence against infection. After the first 6 months, however, the child needs extra nutrition and research indicates that the weaning period is the most critical period for the child from the point of view of morbidity and mortality (Winikoff 1982). Early weaning, late weaning, inadequate or inappropriate foods, and contaminated weaning foods are all responsible for increased infant and early child mortality (Gordon et al. 1963). Many studies have drawn attention to the beneficial effect of breast milk. The counter arguments to bottle feeding are becoming more effective (Baer 1983). Poor nutrition exposes the child to greater chances of infection and repeated infection reduces the nutritional level of the child. Protein Energy Malnutrition (PEM) leading to marasmus and kwashiorkor is probably the "hidden killer" of many children, through their exposure to infectious diseases such as measles, diarrhea with dehydration, and respiratory tract infections.

State of Exposure to Infection and Disease

The transition from a healthy state to a state of susceptibility to infection and disease takes place, in most cases, through the passage to the state of malnutrition. The prevalence of infectious diseases in the neighbourhood and the susceptibility of the child brought about by malnutrition determine the chances of infection and disease. Many factors are responsible for this malnutrition syndrome as discussed above. Other factors such as personal hygiene of the child, toilet facilities, safe water supply (Meegama 1980; Caldwell et al. 1983), and prevalence of diseases in the environment also influence the child in succumbing to infection and disease (Anker and Knowles 1980). These variables can be influenced by others such as mother's education, father's education, climate, household income, and community sanitation (Caldwell et al. 1983; Palloni 1983). These variables are, in turn, affected by global factors such as national income, national policy, migration during wars and famines, and the absence or ineffectiveness of preventive and curative health-care programs. It is important but also difficult to evaluate the contribution of each of these factors, in the presence of many other relevant factors, to child morbidity and mortality.

State of Low and High Resistance

The human body, from the moment of birth until the last breath of life, is continuously exposed to diseases. What determines survival is resistance to disease, which can be viewed as consisting of two components. One is purely determined by genetic factors and, over the life of the individual, might remain constant. The other is acquired. Innate immunity contributes to the first type of resistance. But this basic level of resistance can be improved or lowered by socioeconomic and personal characteristics of the host. Mention has been made of the synergistic effects of malnutrition and infection that tend to lower host resistance and operate cyclically. Other aspects of child care further affect resistance. Higher infant mortality rates for males compared to females is frequently attributed to females' higher resistance to disease and infection. It may be recalled that behavioural factors such as preference for male children and short duration of breastfeeding also contribute to lower resistance through the mediating effects of malnutrition. All these factors can be treated as more-proximate determinants of ICMM compared with household income, poor maternal care, parental education and occupation and so on.

High resistance to infection is mostly due to host immunity of either an active or passive type. Maternal immunization offers a child passive resistance. The child acquires active immunity by previous exposures to infections and disease and through immunization programs. The resistance in the child can be enhanced greatly by following the recommended immunization schedule for polio, measles, typhoid, tetanus, and pertussis. The child's resistance is also built up by breastfeeding, optimal use of baby foods, and proper medical care.

This is an area where definition and measurement problems abound. No direct measure of host resistance exists outside the medical laboratory. Only indirect measures such as nutrition and levels of immunization provide the best possible estimates.

Morbid State

Reducing mortality rates alone does not increase the health of children. The level of morbidity must be reduced to attain and sustain low mortality levels in developing countries. Morbidity in a child is not only difficult to define but also to measure. At the macro level, morbidity indices such as frequency of illness associated with waterborne diseases, insectborne diseases, and diseases due to crowding give an idea of the level of morbidity in a population. Disability rates based on hospitalization are also useful. But the measurement of morbidity in the case of infants and children is very difficult especially when the majority live in rural areas. Among children, the principal causes of morbidity are infectious and parasitic diseases; viral diseases such as measles; and bacterial diseases such as cholera, dysentery, and gastroenteritis. Malnutrition and lack of proper medical care are the more proximate causes. In rural areas, both accidental and intentional injuries also contribute to child health and mortality. Here, mothers' education and care will have a great impact in reducing ICMM.

State of Recovery

Recovery after entering a morbid state or at an earlier stage when host resistance is weakening can be achieved through medical care. Chemotherapy and improvement in the nutritional levels will help the child regain a resistance level required to maintain the health equilibrium. Whereas medical care and nutrition are more proximate variables, household income, mother's education, father's education, and standard of living can be treated as proximate variables. As we move further from the individual, the recovery depends on the national income, literacy, level and spread of maternal and child health, nutritional, and family planning programs. The magnitude of the impact of these variables varies from country to country. The state of recovery will also vary between individuals.

Designing Studies Based on Proximate Determinants

From the foregoing review, we can attempt to list the proximate determinants under five categories, following those suggested by Mosley (1985).

I Demographic (fertility) variables
  (1) Age, parity, and birth intervals
II Maternal and child nutrition
  (2) Maternal nutrition during pregnancy
  (3) Breastfeeding
  (4) Child feeding
III Sanitation and environmental variables
  (5) Safe drinking water and good toilet facilities
  (6) Incidence and prevalence of diseases such as diarrhea, measles, malaria, and tetanus
IV Preventive and curative measures
  (7) Birth practices
  (8) Immunization and preventive care
  (9) Curative medical care
V Accidents and intentional injuries
  (10) Accidents and practices such as infanticide and female circumcision

In the literature, many studies have been made to determine the relationship between child health and mortality and socioeconomic and cultural variables. The simplest studies are those based on censuses and governmental statistical publications. These studies have helped to establish mortality differentials. More powerful methods, although indirect in nature, have been developed and applied to the routine tabulations of children ever born and surviving by age of the mothers (Mensch et al. 1983). Sample surveys conducted with specific objectives, such as the World Fertility Survey Program that included household as well as individual questionnaires, have helped to sharpen mortality differentials. These studies, which are based on relatively large sample sizes, have helped establish the association between infant and child morbidity and mortality. By their very nature, however, they are not particularly useful in establishing causal linkages.

In recent years, micro studies have attempted to focus more closely on a small number of cases. Such studies are usually prospective and longitudinal. Micro studies using an anthropological approach have also contributed immensely to our understanding of the underlying mechanisms of child health and mortality. These studies, although offering greater depth, lose generality, which is crucial for designing health interventions.

A synthesis of the macro and micro approaches, retaining the strengths of both methods, appears to offer more than either one used individually in the study of determinants. Three important studies in this connection come to mind. One is a longitudinal study in South India by Caldwell et al. (1983) that employed both the sample-survey approach and the microstudy approach with an emphasis on intensive observation. This study has considerable social content and many qualitative observations are employed in the analysis. The other studies, one by Julie Davanzo et al. (1983) in Malaysia, the other by Barros et al. (1986) in Brazil, are unique in the way biomedical and social variables are incorporated in a carefully designed survey. For example, both studies have included proximate determinants such as birth weight, birth order, duration of supplemental breastfeeding, sanitation, and household density.

Where financial constraints are not serious, the establishment of population laboratories probably offers the best understanding of the complex mechanisms underlying child health and mortality. Two such studies can be cited: the Matlab studies in Bangladesh and the Gandhigram studies in South India. The results coming from such longitudinal studies with action program components are of greater value than many sample-survey studies. The studies based on Ngayokheme in Senegal and the Danfa Project in Ghana are also useful examples.

In view of the costs involved in establishing such population laboratories, efforts must be made to seek assistance from international donor agencies such as IDRC, UNICEF, WHO, UNDP, and the national governments concerned. The benefits from such an effort in our understanding of the complex process of child health and care will far outweigh the investments.

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SOCIOECONOMIC DETERMINANTS OF CHILD HEALTH IN GHANA

Patrick A. Twumasi

Introduction

In this paper, the author discusses socioeconomic determinants of child health in Ghana. The data for the paper were based on the findings of research work that the author and other social and medical scientists have conducted in Ghana over the last 20 years. The main thesis of this paper is that child health and child surviving techniques from birth to age 5 years (at least) depend to a large extent on the social and economic position of parents who actually take care of children within that age group.

Review of Literature

Health and illness issues are not only the concern of medical and biological sciences, on which the practice of medicine is based, but are matters of broad social concern. Although a greater premium is put in humanitarian considerations, there is also an utilitarian interest in ensuring that all children are able to grow and develop to the maximum of their capabilities. According to Lamb and Solomon (1965), the achievement of humanitarian and utilitarian goals in health care involves social and medical institutions. The work of health professionals and allied workers is an essential institutional input because they are charged with the responsibility of dealing with specific health problems. The social nature of health care also involves the public at large. They must know and understand the norms and the world view of health institutions in existence and are constantly active in ensuring proper health care for children.

Good reasons exist, therefore, for regarding health and illness in their many aspects as social and economic phenomena (King 1963). The behaviour surrounding health and illness issues, whether we are concerned with health services, health professions, therapy management groups, or patients, is social behaviour. Health behaviour involves not only single individuals but persons interacting with one another and with the environment in a network of social relations. And, as argued by Gunnar Myrdal (1968), health affects social factors and social factors affect health.

In the past few decades, research scientists have become more interested in examining various aspects of health behaviour and in providing an analytical framework for the study of child survival (Mosley and Chen 1984). The interests have arisen from theoretical, methodological, and practical concerns. Theoretically, the intermediate linkages in causal relations must be examined. From a methodological point of view, the issue is to determine reliable and valid routes through which causal linkages may be defined. For practical purposes, the end result of research studies on children is to assist policymakers to make decisions and policies that improve the socioeconomic environment in which children are located.

In Ghana, Professor Easmon (1968) has drawn attention to the growing interest in patterns of children's diseases and illnesses and in public health programs. His report submitted to the Ghana Ministry of Health in 1968 listed many children's diseases as preventable and having clear social linkages.

The problems for policymakers are apparent in Easmon's report that sought to establish a relationship between social environment and preventable and communicable diseases. First, social factors operate in the causation of a broad spectrum of diseases. Second, social and cultural factors are relevant in the incidence and prevalence of childhood diseases. The socioeconomic status differentials of parents are of prime importance here. Sometimes, as in the case of occupation, there is a fairly specific connection between a social phenomenon (occupation) and exposure to conditions that result in disease. The income of parents, as well as residential arrangements, are also relevant factors. The social phenomenon of poverty, often cited as the major social enemy of child's health, appears to be at work in a number of situations ranging from deficiency diseases resulting from malnutrition to a high incidence of infection attributed to overcrowding and, in fact, to the total way of life of a people. Ignorance and superstitious beliefs also underlie many illnesses of children.

Further, in Ghana, as in many countries in tropical Africa, traditional modes of life (i.e., based on kinship practices) prevail that tend to encourage the existence of tropical diseases. The majority of Ghanaian people (69%) live in rural-traditional areas, according to the 1984 population census (Table 1). The urban population is estimated to be 31%. In urban areas, a constant interplay often exists between modern and traditional values and the urbanite, even though in the city, maintains traditional ways of life.

Kinship plays a very important part in the life-styles of the total Ghanaian population. This is in evidence when one observes a

Table 1. Population of Ghana by age and sex (1983 mid-year estimate).

Age (years)	**Male**	**Female**	**Total**	**%**
0-4	1 110 149	1 290 674	2 400 823	19.1
5-14	1 602 016	1 865 747	3 467 763	27.6
15-45	2 314 535	2 752 574	5 067 109	40.3
45+	713 413	912 751	1 626 164	12.9
Total	5 746 113	6 821 746	12 561 859	100

Note: Estimated national population density is 53/km^2. About 69% of Ghanaians live in rural areas.

Source: Census Office, Statistical Service, 1985.

typical household. The norms are enshrined in traditional cosmological patterns. The best way to act is considered to be the way the ancestors have prescribed. For this reason, traditional elders play a crucial role in child socialization. They advise mothers to maintain the established norms. For example, social causation theory (Turner 1967; Twumasi 1975), in which witches and the evil eye appear, is used to explain sickness. People's notion of germ theory is very poor and its explanatory usefulness is often seen as incidental. For this reason, one often sees the environment of traditional households as deplorable. Apart from poverty, ignorance and superstitious beliefs contribute to the maintenance of poor environmental quality.

In traditional households, communal ways of life prevail. Members of a family or extended family often share the same utensils and drink from the same cup. Stored water often becomes infected whenever one member of the family is sick. Sick children are often not isolated and sleep on the same mat with other children, consequently spreading infectious and communicable diseases. Traditional belief systems and communal ways of life add to the rapid spread and prevalence of diseases in children.

As estimated by Gaisie (1979), the mortality rate is high among children aged 0-5 years. It is specified that 50% of the deaths occurring in the Ghanaian population fall within this age group. In other words, as argued by Ware (1984), children suffer the brunt of the burden.

Studies by Gaisie comparing rural and urban mortality rates have shown a positive correlation between socioeconomic factors and diseases in children. In Ghanaian urban areas, in many instances, there is overcrowding and pockets of unsanitary conditions. Geographers have conducted definitive studies that indicate that, in many urban areas, sanitation is poorer than in rural areas. In urban communities, toilet facilities are poor and drainage and pipe-borne water system are not dependable. Parents, therefore, especially those from poor families, find it difficult to raise their children in a healthy environmental setting (Prothero and Davenport 1986).

In the rural areas, in contrast, the population density is low. Thus, rural inhabitants have a large ecological environment to themselves. Although modern amenities and facilities are not readily available to support modern child-rearing practices, rural families manage to keep their environment relatively tidy. The problem encountered in rural areas is the prevalence of ignorance and superstitious beliefs.

The connection, therefore, between ill-health and physical circumstances of life is fairly obvious, but the picture is often complicated because of the remarkable interplay between rural and urban migration. There is frequent interaction among rural and urban people. Rural people visit their relatives in the urban areas. And at the weekends and on festive occasions, urban dwellers frequently visit their rural folks.

In good public health systems where infrastructural facilities are available, many of the diseases will not occur, because they are often associated with ignorance, poverty, and with poor quality of environmental life. Studies indicated clearly that poor families use hospitals more frequently than the rich (Twumasi and Boateng 1972).

Epidemiologists and sociologists have also examined variables such as ethnicity and religion to determine whether there are causal connections between these variables and childhood diseases. Religious and ethnic groups share common attitudes, values, and habits and within the group, members have similar world views on questions of health. Religion is regarded as an element in ethnic culture and is analyzed as an independent variable. A direct relationship between religion and health occurs when an individual is predisposed to accept or reject certain health practices on the grounds of faith, and when parents refuse inoculation or immunization for their children because of a particular religious affiliation. It is possible to find direct associations between the distribution of disease and behaviour derived from religious dogmatism. King and Funkenstein (1958), in their study, discovered a correlation between the structures of religious beliefs and physiological responses to illneses. The interpretation of their findings was that patterns of religious practices can affect the health of a family group and can contribute to individuals' responses and modes of seeking traditional and modern health care.

Ethnicity is also considered important in disease linkages because of differences in the various life-styles of ethnic groups. Modes of socialization, food habits, and environment are dissimilar. Among some ethnic groups in Ghana, certain foods and vegetables, as well as meat, may not be eaten. Some may also resort to tribal marks, clitoridectomy, and other ritual practices. For example, among the Kassana of Northern Ghana, clitoridectomy is still practiced on preadolescent female children. The health hazards of such a practice are enormous.

To conclude this review, socioeconomic status must be noted as an important intermediate variable when examining the relationships between health status and disease causation. Included in this concept are the suborder variables of income, occupation, education, residential arrangement, ethnicity, and religious affiliation. These variables are relevant in causal analysis. They produce broad groupings of people who have similar habits, values, and attitudes, groups of people who tend to share the same way of life because of their common orientation to fundamental value systems. They help to formulate a model that shifts emphasis from monocausal explanation (for example, reference to germ factors) to a more complex analysis of sociological linkages.

When income is used as a criterion, the connection between health and socioeconomic status is obvious. Poverty and its companions, overcrowding and malnutrition, tend to increase susceptibility to illness, especially infectious diseases. Indices such as religion and ethnicity are factors that provide further insights into modes of life of parents. They suggest patterns of life-styles and of utilization behaviour that affect child health.

Research Commitment

A variety of factors at individual, household, and community levels affects child mortality. Researchers must closely examine the range of socioeconomic determinants that operate at these different levels and illustrate the linkages.

At the household level, kinship influences must be examined to assess their effect on behaviour and child socialization. Income, wealth, and family resources must be examined in differential analysis. Then, the level of resources and quality of life of a community from different points must be studied to determine the crucial linkages. The socioeconomic station of life is crucial, as we have discussed, in affecting food supply, food habits, food preparation, sleeping accommodation, and water supply, in terms of both quality and quantity. Comparative analysis of experimental and control groups of children in urban and rural communities must be carried out quantitatively.

The income level of a particular household or individual parent affects the type of clothing, housing, fuel consumption, food, information flow, and use of health services. Without doubt, income is a powerful determinant in child morbidity and mortality studies. But why is it that, in the same situation, some children die and others do not? Research must be pursued in this direction.

Traditional norms and attitudes toward child health care can modify economic choices and health-related practices. Parents may have economic means, but not be able to give proper care and attention to children because of the use of househelpers. In Ghana, many urban families delegate child care to housemaids who are from lower socioeconomic strata and may be ignorant of proper methods of health care. Caldwell (1979) postulated that one significant change in traditional societies produced by a higher level of maternal education is a shift of intrahousehold power toward the mother to the benefit of her offspring.

Health Problems of Children

The bulk of health problems of children in Ghana is caused by communicable diseases and malnutrition (Table 2). Under communicable disease are maladies that can be passed from one person to another by direct contact, sometimes through the medium of air or water, and by means of animal and insect vectors. The most common problems are diarrhea, dysentries, malaria, hookworm, and schistosomiasis. All these diseases are linked with socioeconomic factors, notably poverty and ignorance (Colbourne et al. 1956; Asirifi 1966; Ashitey et al. 1972).

In hospital statistics, about 50% of all deaths occur in the under-5 years age group, meaning that in Ghana, as in much of sub-Saharan Africa, the health environment is poor. According to the World Population Data Sheet of the Population Reference Bureau, Washington, 1984, the average infant mortality rate per 1000 is 28 in developed countries, 107 in developing countries, 243 in Africa, and 115 in Ghana.

The predisposing factors that aggravate the transmission of diseases in children in Ghana include unsanitary environments, lack of adequate water supply, poor dietary practices, inadequate food intake, overcrowding, a poor waste disposal system, low literacy rates, ignorance, and low income (Ashitey et al. 1972:268).

Table 2. Distribution of certified deaths, by cause, in the age group 0-5 years, Ghana, 1968-77.

Cause of death	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Measles	513	548	755	1069	948	1014	1005	1174	1004	1227
Gastroenteritis, enteritis, diarrhea of newborn	646	747	554	608	560	757	684	704	618	828
Bronchopneumonia	723	707	537	621	645	665	559	678	783	812
Marasmus, cochexia, feeding problems of newborn		330	112	277	330	256	534	503	652	745
Prematurity	607	634	678	858	792	923	859	724	729	723
Malaria	908	758	701	790	855	800	579	600	621	696
Asphyxia atelectesis	251	312	321	415	446	412	471	507	560	548
Tetanus	260	309	316	312	310	342	328	362	330	410
Convulsion	158	212	129	127	197	208	252	199	276	392
Malnutrition	672	250	238	199	241	220	2411	199	272	332
Pneumonia of newborn	252	243	231	298	259	300	311	293	271	320
Kwashiorkor	235	283	157	226	242	300	355	283	312	248
Meningitis	103	123	117	140	173	192	177	196	216	247
Umbilicus Sepsis	79	73	127	80	119	95	122	139	211	186
Birth injury	122	110	138	158	155	140	148	186	183	168
Hepatitis	54	58	41	22	31	47	41	35	64	158
Dehydration	57	107	90	51	56	72	64	106	165	152
Congenital malformation	56	76	113	93	104	96	85	101	107	109
Fever	46	103	34	16	42	39	14	22	21	58
Burns	33	37	33	39	38	37	50	53	42	55
Hemolytic disease, kerniterus of newborn	99	65	106	100	110	58	121	130	146	54
Typhoid	20	13	28	31	54	57	41	35	36	51
Bronchitis	46	53	24	47	45	41	62	49	46	45
Whooping cough	28	17	34	37	30	42	22	34	38	43

continued

Table 2. Continued.

Cause of death	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Hemorrhagic disease	-	47	215	-	-	-	27	44	28	38
Shock	3	4	3	1	4	1	5	-	35	33
Tuberculosis	25	45	46	26	33	32	32	41	33	29
Sickle-cell anemia	27	31	24	31	46	70	34	41	27	28
Peritonitis	28	25	11	7	20	18	15	12	20	28
Dysentery	71	64	49	28	16	16	14	8	10	8
Black water fever	2	1	2	2	-	2	3	3	-	-
Unclassified	390	479	685	714	667	1118	616	784	836	880
Total	6532	6923	6649	7423	7568	8376	7871	8245	8692	9654

Source: Ministry of Health, Health Education Unit 1985.

Dr Asirifi analyzes the various reasons why a large number of children are admitted into hospital at a late stage of their disease, often the final stage. Five reasons are given for this:

- The inconvenience and expense of hospitalizing little children.
- The inconvenience for mothers with many children. Many women of poor socioeconomic status do not have domestic help.
- Traditional concepts die hard and, in some cases, only at the terminal stage of diseases are children taken to the hospital after trying traditional cures.
- The need for a death certificate makes parents rush a child to hospital as a matter of convenience.
- Children come to hospital so late because parents are ignorant about the nature and causation of disease and cannot appreciate its seriousness until too late.

Ignorance and superstitious beliefs underlie many aspects of traditional culture, affecting recognition and causation of illness in children. This point was stressed vividly by medical research scientists in a medical survey in a typical cocoa-belt village with a population of about 255 (Colbourne et al. 1956). Few people lived beyond the age of 50 years. Anemia was generally prevalent. Intestinal parasites were common among children, and malaria and yaws contributed to high child mortality. The critical period occurred at weaning (between the 1st and 3rd years) when, in the absence of dairy products, the child was put on a starchy diet deficient in vitamins. Consequently, there was a high incidence of malnutrition in the 1-5 year age group.

Lack of an adequate water supply for households leads to smaller quantities of water being used for household purposes than is necessary for the maintenance of health. It is difficult for such households to prevent diseases such as diarrhea, dysentery, and many skin infections. Again, lack of proper sanitation may contribute toward the presence of insect vectors such as the house fly and mosquitoes. Further, poor sewage disposal encourages the spread of parasites such as hookworm.

It must be stated in an axiomatic fashion that, in Ghana, the percentage of the population that has access to pipe-borne water and to modern sewage disposal is directly related to per-capita income. In Ghana's economic situation, less than 30% of the population is estimated to have access to safe water. Those populations with access to a safe water supply live in the cities and in district towns. In the rural areas, where most of the population resides, people do not have access to safe water. David Werner (1977) has appropriately summed up the situation.

> Poor nutrition, poor hygiene, poor water supply, low literacy and high fertility help account for the high morbidity and mortality of children. But as we all know, the underlying cause - or more exactly the primary disease - is inequity; inequity by wealth, of land, of educational opportunity, of political representation and of basic human

> rights. Such inequities undermine the capacity of the peasantry for self-care.... In spite of national, foreign and international gestures at aid and development, the rich continue to grow richer and the poor areas poorer.

The poor health of children is a symptom of poverty and the health of children will be improved when the socioeconomic system is improved.

Solution

The general causes of and solutions to child health problems are fairly well known. In fact, it was in line with the existing knowledge of the causes and solutions that, in the 1986 Report on the State of the World's Children, the Executive-Director of UNICEF threw the challenge to member nations, especially high mortality nations, that the adoption of four simple and inexpensive measures could help reduce childhood deaths by half and thus save the lives of about 20,000 children daily (Ubomba-Jswa 1986). UNICEF argues that the combined effects of these measures would bring about a low-cost revolution in child health and child survival. The four measures are: growth monitoring, oral rehydration therapy, breastfeeding, and immunization (UNICEF 1986).

The Government of Ghana has accepted primary health care as an instrument for health development in this country. It is within this frame of reference that child health can be tackled. Primary health care per se goes beyond traditional medical emphasis on curative medicine. It incorporates in its usage the recognition of nutritional, agricultural, house planning, and community health education. Apart from socioeconomic factors, a basic public health education aspect will help to reduce ignorance and superstitious beliefs.

Primary health care is defined as basic health care. In addition to the provision of a clinic to treat minor ills, it is expected that local communities will form village health councils. The community needs total health care rather than fragmented care. It needs promotional, preventive, and curative care. The health needs of a community are broadened to include improvement in the total environment, in nutrition, agriculture, and in public health. (See Table 3 for the percentage distribution of health expenditure between 1973 and 1982.)

Table 3. Distribution (%) of health expenditure.

Service	1973/74	1974/75	1975/76	1979/80	1980/82
Preventive medicine	12.3	10.3	9.7	9.5	9.5
Curative medicine	77.1	76.3	75.9	76.7	75.5
Research work	0.2	0.4	0.5	0.5	1.6
Administrative	10.4	13.0	13.9	13.3	13.4

Source: Ministry of Health, Government Printer, Accra, Ghana.

Although the concept of total health care is not new, its implementation is receiving new impetus and is redefining the role of the primary health care worker. The competence and skill expected of the primary health care worker toward the client and the remainder of the community need reconsideration. It is the responsibility of each health council unit to identify its own health care service, and to support the training of the primary health care worker.

The goals of a primary health service as visualized in this manner are wider than the conventional ones and "range from that of health as a political and social right to that of health as an expression, or spin-off, of a quietly functioning informed community" (Newell 1976).

For the primary health care worker, the issue involves a cooperative approach with the agricultural extension worker, the community development officer, the school-teacher, for example, as well as with the individual members of the community he or she seeks to serve and their local leadership and administrative officials. Whatever the specific health activities, the primary health care worker is involved in maternity welfare, immunization practices, first aid, pure water supplies, antimalaria procedures, referral, as well as health education. As stated by Newell (1976), competence in identifying symptoms and relating these to environmental or communal matters is required, as well as the ability to recognize one's level of competence.

The village health worker needs basic education and training to work in a specific area, to educate the public, to treat routine ailments, and to refer complex cases. As far as collective communal action is concerned, the primary health care worker must be able to help the development committee members to recognize when it is necessary to seek technical assistance to resolve matters outside the competence of immediate and available resources, and how to do so. Where referral is necessary, the primary health care worker must be able to identify and describe symptoms simply and clearly in a way that explains the urgency of the action, yet avoids stimulating panic or, alternatively, a sense of despair. Where choice may exist between a traditional mode of care and a modern method of treatment, there must be the competence to identify the more appropriate procedure in the given circumstances.

The traditional healer of various persuasions must find a place in the committee. This is a consideration that may involve systematic investigation into traditional practice and the cooperation of modern and traditional modes of control and treatment of community health problems. This relationship can help improve the health environment of the community. Crucial attention must also be paid to the interplay of socioeconomic factors as they bear upon health: land tenure and food production at subsistence as well as commercial levels; production and marketing as they are affected by transport facilities; the significance of malnutrition; and collective production effort. Family planning, population control, and the general relationships between providing preventive and curative health facilities and other developmental activities must receive attention.

Knowledge by itself does not necessarily lead to changes of attitude. These are more likely to happen if what is proposed is not too far removed from familiar thoughts and practices of the persons it is desired to influence. By applying primary health care programs, village communities, where the majority of our people reside, can improve the way of life of the population. As discussed in the introductory pages of this paper, improvement in the socioeconomic lifestyles of parents will positively affect the health status of children. In translating these ideals into reality, primary health care programs can affect positive changes in the life-styles of children.

Discussion

Poor housing conditions, lack of adequate socioeconomic status, and poor education contribute to many preventable diseases. In Ghana, the argument put forward by the health authorities is that the two main causal agents of infectious diseases are malnutrition and unsanitary conditions. These are more likely to be found in areas of low income groups and people with little or no education. Among families with reasonable living standards, there is a relatively low infant death rate, because of an awareness of health problems and the capacity to live in decent houses. In his book Asian Drama, one of Myrdal's (1968) central themes is that one cannot isolate health standards from the total developmental process. People in the higher socioeconomic groups are favoured in this respect. They can afford to "live clean." They can clothe and feed themselves properly. Health affects socioeconomic factors and is itself affected by socioeconomic factors, notably income and level of living. Recognizing this interrelationship, one beware of oversimplifying the understanding of health by isolating it from the total developmental process. This implies that rationally (to cut down on the cost factor) health problems should be integrated with general planning for development.

It is difficult to determine how much understanding exists between an illiterate population and the scientific medical community in terms of disease causation or establishing cordial therapeutic relationships. Medical sociologists have found that cultural systems tend to colour one's orientation regarding medical notions. Data on Achimota Village, Adabraka, and Tesano, from a study conducted by the author, clearly indicate that modern medical consciousness is developed in people who have had formal education; that the higher one's educational level, the more aware one is of health problems and medical personnel. Whether a person views the doctor as a relevant helper will depend on various factors such as social background and information, personal characteristics, how particular indications of illness are perceived and defined, the social and physical accessibility of the doctor, the personal costs of seeking medical help compared with alternative approaches, and many other social-psychological factors. The ability of a person to cope with medical problems depends on how the problem is defined: the causes, the alternatives for reversing the problem, and the resources available for making use of the various alternatives.

The life-styles that characterize various social groups may expose them to different environmental risks. These risks may occur with greater frequency and intensity in some social strata compared with others. They are not distributed throughout the socioeconomic structure in any consistent way because other social-psychological factors need to be taken into account. In short, it is reasonable to assume that poverty and lower social status may produce greater disease risks in children than does the style of life characteristic of the affluent classes. But we must not fail to note the extent to which variability is apparent within particular socioeconomic categories. At present, however, there is a link between social position and health status of children: the lower the social standing, the greater the risk of disease.

Recommendations

Although doctors must continue to treat human ills in a developing nation such as Ghana, an emphasis on prevention is more crucial. Data clearly point out that a relationship exists between socioeconomic standing and the use of health services.

Comparative studies of use of health services must allow for possible age, sex, and social class differences in the population to be studied. At most, however, these variables may provide some idea of patterns and variations of use of services. Except for age and sex, socioeconomic variables do not reveal why variations exist. Future research may look into these. This context then becomes the frontier of social research on the use of health services. There are many social-psychological factors that can be studied, e.g., perceptions of health and health services in different situations, general life-styles, the priorities families place on how they spend their money, and the knowledge of disease.

Conclusions

This paper has attempted to show that socioeconomic factors are crucial in studying diseases of children. Having recognized the importance of socioeconomic indicators, it was necessary to draw attention to common communicable and nutritional diseases of children. In Ghana, the traditional way of life, kinship systems, interpersonal relationships, value orientation, ignorance, and poverty were deemed to be critical factors in children's diseases and in disease prevalence.

In any long-term solution to the problem of child health and child care, we must act on the practice of primary health care as an instrument for health development in our communities. It is within this developmental strategy that the socioeconomic awareness of our communities can be activited to create a healthy environment and to speed up the needed revolution in child health.

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METHODOLOGICAL AND OPERATIONAL PROBLEMS IN THE COLLECTION OF DATA ON INFANT AND CHILD MORTALITY

Rebecca Appiah

Introduction

This paper attempts to examine some of the problems encountered in the field in collecting accurate data for the estimation of infant (under 1 year in age) and child (ages 1 to 5 years) mortality. It will deal mainly with direct techniques although references will be made to indirect methods such as those of Brass et al. (1968). It will also examine some of the limitations in the data collection procedures relating to infant and child mortality, in particular the validity of some concepts used and some cultural factors that affect the collection of accurate data on mortality differentials. The paper draws mainly on the concepts and questions used in surveys conducted by the Ghana Statistical Service, i.e., the Post-Enumeration Survey of 1960, the 1971 Supplementary Enquiry, the Ghana Fertility Survey (1979-1980), and the Danfa Project.

The rapid decline of mortality in developing countries after World War II has been attributed mainly to the introduction of immunization and modern medicines (mostly vaccines and antibiotics). The single largest group that benefited from this technology transfer has been children because most vaccines protect children against major child-killer diseases such as measles, small-pox, whooping cough, diphtheria, tetanus, polio, and tuberculosis. Quite recently, oral rehydration therapy has also contributed significantly to lowering infant deaths from diarrheal diseases. Increasing public health education on maternal and child health has contributed highly to the decrease in infant and child deaths. Since the 1970s, however, the previously rapid decline of infant mortality has slowed down in Africa. This has been partly attributed to the economic recession with its attendant nutritional inadequacies and deteriorating sanitary conditions, and partly to the fact that mass disease eradication efforts have not had their maximum impact. In connection with the latter, the World Health Organization in 1974 established the Expanded Programme on Immunisation. UNICEF is now taking a leading role in this program and, together with WHO, hopes to cover areas that have hitherto not benefited from such programs.

Considerable attention has been paid to reducing infant and child mortality in developing countries recently because this is an indicator of the quality of life. Not only is the information required for the country as a whole but, for proper planning of health programs and control of communicable and other diseases that affect infants and children, such data must be available at the lowest level of administration. In Ghana, this will be the district; in Nigeria, it will be the local government; and in Sierra Leone, the chiefdom. Moreover, in recent times, attention has been focused on the relationship between infant deaths and fertility in developing countries. It is argued that fertility levels will decrease only when there is a substantial decline in the level of infant mortality. Data on infant and child mortality in addition to that of fertility will enable us to test this hypothesis.

Ghana has also benefited from the world-wide decline of infant deaths. Infant mortality rates using Brass and Trussel mortality estimation techniques were 150 and 121 per 1000 births in 1960 and 1971, respectively (Ghana Fertility Survey 1983). The levels estimated directly from the 1960 and 1971 surveys were 126 and 87, respectively. Estimates for 5-year periods from the Ghana Fertility Survey range from 111 in the early 1950s to 70 for the 1974-1978 period. Although the data presented above vary, the results reveal that infant mortality has decreased considerably.

The study of infant deaths is desirable in itself because reducing deaths is a priority of most governments (especially infant and child deaths). The level of infant mortality in a country indicates the level of health conditions; therefore its decline directly reflects the improvement of health conditions. Because infant mortality levels differ according to region, educational and occupational group, age of mother, parity, and rural or urban residence, however, the study of mortality differentials becomes as important as the study of its levels. The differentials make it possible to identify the underprivileged sections of society that experience higher infant mortality levels and thereby formulate appropriate strategies to improve their living conditions and improve their survival chances. The study of infant and child mortality differentials also increases the understanding of the determinants of mortality and their interrelationships. This also enables policymakers to enact appropriate policy measures for reducing mortality, especially in the light of the Alma Ata declaration of Health for All by the year 2000.

Data Requirements

To measure infant and child mortality levels, data on children (by sex and date of birth) born alive to female respondents (of a specified age range, usually 15-45 or 15-49 years) during the 12-month period preceding the survey or census and deaths by sex and date of death of children born during the 12-month reference period are required. Data on the number of children ever born alive, classified by 5-year age groups of mother in addition to the total number of women in the 5-year age group, are also required. These data should be available for either one survey or census, or for two censuses or surveys taken 5 or 10 years apart.

To interpret differentials of infant and child mortality, information relating to the socioeconomic characteristics of the parents is also required (in addition to the data required in determining infant and child mortality). Usually the following information is collected: age of mother, ethnicity of mother/father, religion of mother/father, childhood rural/urban residence of mother/father, current rural/urban residence of mother/father, education of mother/father, occupation of mother, and marital status and duration of marriage of mother.

Source of Data

Data used in the measurement of infant and child mortality are usually obtained from vital registration (of births and deaths), censuses, and surveys. In Ghana, the current registration form for decedents contains information on name, sex, age, date of death, nationality, name of mother (if decedent is less than 15 years), place of death, and usual place of residence (of decedent). For births, name, sex, date of birth, type of birth, place of delivery, nationality, usual residence, and name of mother, and name and nationality of father are obtained. Examining the items for which information is collected suggests that the data obtained is inadequate to measure differentials. This deficiency is characteristic of most vital registration systems in developing countries. Another deficiency of vital registration is its failure to record all events when they occur. Usually most births are either not recorded (especially of infants who die young), or are recorded later, in many cases when the children are grown. The registration of deaths is even worse for infants who die very young. Coverage of both births and deaths in Ghana is currently estimated at 40-45% for regional capitals and about 20% for towns with populations of 5000 and over.

When surveys and censuses are used to provide information on infant and child mortality, retrospective questions are asked. First, births to female respondents (within a specified age range, usually 15-45 or 15-49 years) during the 12 months preceding the survey or census are determined, then deaths of children born alive during the same period. In both cases, data on their sex and date of birth and death are also collected. This method was used in both the 1960 Post Enumeration Survey and the 1971 Supplementary Enquiry. To counteract misplacement of dates of birth and death of infants, some surveys ask information on births and deaths during the 24 months preceding the survey, and then detailed questions are asked on each birth and death within that period. In this way, births and deaths that do not belong to the specified 12-month period are eliminated. However, the advantage of the 24-month reference period over the 12-month period is yet to be proved.

Another variant of this method is the multiround survey. A baseline survey is carried out to obtain basic characteristics of households. Subsequently, periodic visits at intervals of 3, 6, or 12 months are made to record changes in those households. The Danfa Project, for example used 12-month periodic surveys. The multiround survey, it is argued, is better able to capture all births and deaths occurring in households that would otherwise be missed or not reported in a single-round survey. There are also variations of this approach that use both retrospective and registration approaches. A refinement of this method is the use of the dual-record system to match information from the survey and the registration, and to apply the Chandra-Sekaran-Deming formula to estimate the number of events that actually occurred during the period.

In another type of questionnaire, birth or pregnancy histories or both are used to collect information on birth and death of infants. In this case, detailed questions on each birth or pregnancy are asked. The objective of this method is to eliminate the omission of some births and deaths. The birth histories procedure was used extensively in the World Fertility Survey in conjunction with pregnancy histories, but the latter was only used to collect information on pregnancies that did not end in live births. The main objective was to capture situations where death followed soon after a live birth, and may be regarded by the respondents as nonlive births.

Pregnancy histories can also be used on their own to obtain data on all pregnancies whatever their outcome. Even though both birth and pregnancy histories are designed to eliminate omission of births and pregnancies, the likelihood that some respondents may deliberately not mention some births or pregnancies cannot be overlooked. This is likely to occur where respondents might have resorted to abortion to terminate unwanted pregnancies and also when respondents may want to conceal, from their current husbands, live births that did not survive, or births that occurred when they were much younger.

In both methods (i.e., retrospective questions and birth-pregnancy histories), data on the number of children ever born to female respondents (within a specified age range) and the number dead are also collected through direct questions. To eliminate omission of some children, especially those who are not living with respondents and those who died soon after birth, the following series of questions are usually used instead of just one or two questions.

How many of your own children...
a. live in this house?
b. live elsewhere in this town/village?
c. live in another town/village in Ghana?
d. live outside Ghana?
e. are dead?

The sum of the responses gives the number of children ever born. The above questions were used in both the 1960 Post Enumeration Survey and the 1971 Supplementary Enquiry. In the Ghana Fertility Survey, another variant was used. The questions were asked separately for male and female children to further reduce the omission of some children.

The deficiencies outlined in both the vital registration system and surveys and censuses render any data obtained from these far from accurate and, therefore, inadequate to estimate plausible levels of infant and child mortality. For example, as mentioned earlier, direct estimates of infant mortality were 120 and 87 per 1000 live births for 1960 and 1971, respectively, but indirect estimation techniques yielded 150 and 121, respectively, for the same two dates. Because of such discrepancies (a result of omission of events), indirect techniques are used to estimate such rates.

Conceptual Problems

To obtain data on infant mortality differentials, data on the socioeconomic characteristics of parents are collected in addition to data on the infant and child deaths. The data usually relate to rural/urban residence of parents, ethnicity, religion, education, and occupation. But how are these concepts operationally implemented?

Education of parents is usually measured in terms of completed years or type of education or both. During analysis, data are tabulated either by years of schooling thereby disregarding the level, or by level disregarding the years of schooling. Equating levels of schooling with years of schooling, however, causes problems. Twelve years of schooling for one respondent may mean completed secondary and for another completed middle and vocational training. Is it reasonable to equate these two? In the same way, occupations are usually classified in such broad categories that important differences within categories are masked. For example, professionals and their technicians are usually grouped together in one major occupational group as "professional, technical, and related workers." In this category, chemists, medical officers, and engineers are grouped with their assistants. Wide differences exist, however, both in terms of level of education and salaries - variables that have been proven to have considerable effect on levels of infant mortality.

Furthermore, socioeconomic characteristics of parents are measured at the time of survey and are often interpreted as affecting the child's survival chances. But these characteristics might have been different at the time of birth and death of the children. Parents might have changed occupations or educational status. Usually, the analysis is based on the assumption that these characteristics remain the same. Moreover, in some analyses, the educational and occupational status of the "father" is used to determine the status of the household and these characteristics pertain to that of the current husband of the mother. Most surveys do not inquire whether these are the biological fathers or stepfathers of the children being studied.

Field Problems

There are interviewing dimensions to the problems of misdating and recall lapse. In Ghana, attempts have been made to aid respondents in remembering the dates of events through the use of national, regional, and local lists of historical events. Unfortunately, in many cases, this has introduced new sources of error such as the heaping of events. If the heaping occurs within the actual range, no problem exists, but if it occurs outside the range, it poses problems for data collection and analysis. For example, if the intention is to find out the ages of children who died in the last 12 months and the reference event is the expulsion of Ghanaians from Nigeria in January 1983, respondents tend to put children born outside the range within the range. If the person was born in February 1983 and died in March 1984, they tend to compress the timetable around the expulsion date so that this becomes the date of the infant's death.

The problems associated with retrospective surveys as outlined in the previous sections are compounded by cultural factors. Among some ethnic groups in Ghana, mothers who lose children in infancy are encouraged to forget that those children were born. It is generally believed that too much mourning over such children may result in the mothers not having other children. On the other hand, there is a popular belief among the rural uneducated segments of such ethnic groups that if such unfortunate births are ignored, the deceased children may return soon. In addition, people generally do not want to be reminded of their dead children. Respondents, therefore, may not report the birth and death of such children.

However, the cultural practice of some ethnic groups of using a set of names for children may help to reduce omission of events from such surveys. Among the Ga, for example, one cannot have a male child called Kwatelai (i.e., second male child) without having a male child before him called Kwatei (i.e., first male child). Similarly, among the Akans, the name Tawiah is usually used for the male or female child born directly after a set of twins. In the same way, Mansa is always the name given to the third girl in a row. The male equivalent is Mensah. In most cases, the interviewer can obtain complete information on children by asking for the missing names from a set.

Retrospective surveys are also plagued by a high incidence of nonresponse to questions that are considered sensitive. Usually, interviewers are trained not to use culturally unacceptable modes of asking such questions. For example, we do not ask a female respondent "How many of your children are dead?" We usually use the expression that translates approximately in English to mean "How many of your children have passed away?" When interviewers do not ask such questions in culturally acceptable ways, there may be a high level of nonresponse.

Translation of questions is also a problem. In the Ghana Fertility Survey, translated questionnaires were used to elicit accurate information. This was a major departure from the usual practice of the Census Office (Ghana Statistical Service) where translations of the questions are put in the Enumerators Manual. It has not been proven beyond reasonable doubt that one approach is better than the other, although the use of translated questionnaires may pose logistical problems.

Another issue is the type of interviewer to use in surveys on infant and child mortality. Because information on children ever born is best collected from the respondent herself, female interviewers may be better at eliciting more accurate information than their male counterparts. This hypothesis has not been adequately tested in Ghana. It should be noted, however, that in some countries or parts of countries, the issue is not whether women are superior to men as interviewers, it is that women are the only acceptable interviewers. In Northern Nigeria, for example, no male interviewer would be allowed access to women in purdah. A related issue is whether, in surveys involving the collection of data on infant and child mortality, paramedical personnel are preferred to lay interviewers. This hypothesis has also not been adequately tested in Ghana. Even if the null hypothesis is upheld, however, it is doubtful whether enough paramedical personnel can be spared for such surveys. In addition, self-selection of respondents by interviewers may also make the findings unrepresentative. This, however, can partly be remedied by prior listing and selection of households (with names of household heads) to be interviewed.

Conclusions

From the foregoing, it can be seen that even though surveys and censuses are the most common sources of fairly reliable information for estimating levels, trends, and differentials of infant and child mortality in most developing countries, the methodology needs to be refined to provide more accurate, valid, and representative data. In this connection, samples should be large enough to enable further breakdown of broad educational and occupational groups to provide more meaningful interpretations of infant and child mortality differentials.

Developing vital registration systems to achieve more complete coverage should be assiduously pursued as this is the only way to obtain current and (if well developed) accurate information on infant and child mortality. In the short run, however, the vital registration system should aim to fully cover vital events in compulsory registration areas as well as extending the system to encompass countrywide sample areas so that direct estimates of vital events can be obtained on a continuous basis. When the registration system is well developed, more information on the characteristics of parents can be collected and problems of the adequacy of data on socioeconomic characteristics of parents relevant to the interpretation of levels, trends, and differentials in infant and child mortality would be solved.

In the meantime, various techniques can be adopted to improve the estimates from censuses and surveys. The dual-record method can be applied periodically to crosscheck rates from these sources, provided the limitations of the method, such as matching problems and the statistical independence of the two sources of data used for matching purposes, can be taken into account.

The multiround survey, which is like a longitudinal survey, can provide reliable information, but the attrition rate of respondents (i.e., respondents who move out of the sample) can be very high as shown by the Danfa Project. Unfortunately, in this type of survey, households dropping out cannot be easily replaced by new households because the main purpose of the survey is measuring changes over a specified period.

Awareness is increasing that demographic surveys that inquire into infant and child mortality may not be the best way to obtain useful and relevant information. A combination of demographic and health surveys in which questions on births and deaths are linked to those on morbidity, nutritional status of mother, causes of deaths, breastfeeding, and so on may be a better approach. The Demographic and Health Survey being carried out by Westinghouse in a number of countries in the world may therefore be the type of survey that can provide a comprehensive data set for the study of infant and child mortality.

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CHILD HEALTH AND CHILD CARE IN PELOTAS, SOUTHERN BRAZIL: METHODOLOGY AND RESULTS OF A LONGITUDINAL STUDY

Fernando C. Barros, Cesar G. Victora, and J. Patrick Vaughan

Introduction

Most less-developed countries face a shortage of reliable information on important aspects of child health and child care that are necessary for the adequate allocation of scarce resources. Common sources of information for the health sector include vital statistics, data derived from periodic censuses, and data obtained through epidemiological field studies. In Brazil, and in many other developing countries, the constraints associated with the use of vital statistics include the high proportion of underregistration of life events and the poor quality of information on death certificates. Although important information can be obtained from censuses, data on significant risk factors, such as birthweight and gestational age, are not usually available. It is therefore important to carry out field research projects aimed at understanding the determinants of disease and death, as well as the patterns of health care, of children of different socioeconomic groups and living in different areas. Such information is likely to improve the effectiveness of social and health interventions.

Epidemiological studies of child health are of three types: cross-sectional surveys, case-control studies, and longitudinal studies. Cross-sectional surveys provide a picture of the current level of health and help to identify immediate health care needs. Case-control studies have been traditionally used to study chronic diseases, but are now being increasingly used to study important aspects of child health and care. Finally, longitudinal or cohort studies are unique in providing the opportunity to follow, through the long term, correlates of birth or early childhood problems. The use of such studies has been restricted almost exclusively to developed countries, probably because they are expensive, time-consuming, and require considerable organization. Among the few examples of cohort studies in less-developed countries, one can cite the Santa Maria Cauqué study in Guatemala, in which 458 children were followed from birth until late childhood (Mata 1978).

In this paper, we discuss some methodological aspects of data collection on child health and care, based on a large longitudinal study of child health that is being carried out in Pelotas, Southern Brazil. Some findings of this study are presented to exemplify possible indicators of child health and care. The longitudinal study of Pelotas was planned to evaluate the influences on child health of perinatal factors, as well as other socioeconomic, environmental, biological, and health-care use variables.

The Pelotas Longitudinal Study of Child Health - Methodological Aspects

The city of Pelotas, located 150 km from the Uruguay border, is the second largest municipality of Rio Grande do Sul, the southernmost state of Brazil. Eighty percent of the population of the state (260,000 in total) is urban. The economic activity of the city centres on agricultural production and Pelotas is the most important rice-processing centre in Latin America. Other agricultural products are potatoes, onions, peaches, strawberries, asparagus, beans, maize, and soya. Cattle and sheep raising are also important activities.

Perinatal Study

During 1982, all 7392 hospital births occurring in the three maternity wards in the city were studied. Only hospital births were studied because of evidence that under 10% of the city's births occurred at home. If there had been a large proportion of home deliveries, a different methodology would have been adopted to ensure adequate representation of the population. During the 1984 follow-up of these children, the actual proportion of home births was determined because we visited all households in the city and inquired about all children born in 1982, including those delivered at home. It became evident that home births were being overestimated, and that hospital births represented more than 99% of the births occurring in that year.

The main objectives of the perinatal study were to determine the perinatal, fetal, and early neonatal mortality rates; to identify possible risk factors and determinants of mortality; to evaluate the patterns of antenatal and delivery care; and to ascertain the coverage of the death registration system (Barros et al. 1984; Barros 1985). The study was carried out at three levels: city hospitals, home visits, and at local registries for births and deaths.

Hospital study

All mothers were interviewed by the research team with the help of a previously tested, structured questionnaire. Questions included demographic, environmental, socioeconomic, and health-care use variables, as well as a detailed history of previous pregnancies. Mothers were measured and weighed upon arrival, and newborns were weighed in the first day of life. The hospital teams were made up of pediatricians, obstetricians, and senior medical students previously trained during two pilot studies.

All newborns were followed during their hospital stay with special attention paid to morbidity and mortality. Newborns were included in the study if the birthweight was equal to 500 g or more and there were signs of life or, for stillbirths, the gestational age was 28 weeks or more (in cases of unknown length of gestation, fetuses weighing 1000 g or more were included). Unequal cut-offs for birthweight were adopted because, for stillbirths, 1000 g is usually considered to be the weight of 28-week old fetuses, and, because of the live births, some babies weighing 500-1000 g will survive the perinatal period, and thus are of interest to the research.

Home visits

A random sample of about 15% of births (1093 babies) was visited at home after the first week. These visits had three objectives.

First, as the perinatal period ends on the seventh day and hospital discharges occurred very early (23% of the families were already at home 24 hours after delivery), a sample of the babies was followed to check their health status. Second, this was a way of double-checking some of the information collected in hospital. Third, information on housing and other environmental conditions could be gathered. These home visits yielded only one extra death that failed to reach the official registration system.

Monitoring of death certificates

All death certificates of babies born in 1982 were checked monthly and were later linked to the information contained in hospital questionnaires. Hospitals and cemeteries were also regularly visited to identify deaths that had not been properly registered.

Follow-up Study

After the perinatal study, a follow-up study of 6011 children whose families lived in the urban area of Pelotas was carried out. The objective was to collect information on patterns of growth, development, morbidity, and mortality, and to correlate these indicators with perinatal, socioeconomic, demographic, and health-care use variables (Victora et al. 1985). Follow-up visits were performed in 1983, 1984, and 1986. A summary of the proportion of children traced and the strategy used in each phase of the study is given in Table 1.

1983 follow-up visit

Early in 1983, we found 81% of the 1820 urban children born in the first 4 months of 1982, with the help of the addresses obtained during the perinatal interview. They were weighed and measured. A questionnaire on socioeconomic, environmental, demographic, feeding mode, hospitalizations, and health-care use variables was completed with the parents.

The first follow-up showed that tracing the children through the addresses given in hospital was very difficult, as many families has

Table 1. Longitudinal study of the children born in 1982 in Pelotas, Brazil.

Year	Study	Place of contact	Target population	% traced	Follow-up strategy
1982	Perinatal	Hospital	All births	>99	
1983	First follow-up	Home	25% sample	83.5	Address
1984	Second follow-up	Home	All births	87.5	Census + address
1986	Third follow-up	Home	All births	=84.0	Census + address
1986	Psychomotor	Home	7% Sample	>80	Address
1982-86	Mortality	Hospitals, registries, cemeteries	All births	-	Monthly monitor

already moved. It was established that a new strategy would be adopted in the next phase of the study.

1984 follow-up visit

This new phase took place when the children were, on average, aged 20 months. Using the city's division into census tracts, we visited all 69,000 urban households of Pelotas, trying to locate all children born in 1982. The questionnaires were then linked to those of the perinatal study and the 1983 follow-up through the name of the mother, hospital, and date of birth. With this methodology, we were able to find those children whose families had moved within the city. After the end of the census, however, there were still 1200 cohort children missing. We then attempted to locate them by the addresses, finding 431 children who had not been located during the census because they had moved during the census, were away from home, or their families had given wrong information to the interviewers. With this methodology, we lost only 12.7% of the cohort children, even with 45% of the families changing addresses since the children had been born.

1986 follow-up visit

We have just completed a new phase of home visits to the cohort children, who were now aged 36-50 months (average 42 months). Again, we initially performed a census of the city and visited all 77,199 urban households. We attempted to locate, through addresses, the children who were not found during the census. With this combined methodology, we were able to locate about 84% of the target population.

Mortality surveillance 1982-86

During the whole study, the mortality of the cohort children has been ascertained through periodic reviews of death certificates at the registries and at the Secretariat of Health. In addition, the case-notes of all children born in 1982 who died in hospital were reviewed to check for possible unregistered deaths. A third source of information about deaths has been contacts with local cemeteries. This was important because we found that, in some cases, the death had been certified and the child had been buried, but the certificate had not reached the registries.

Psychomotor development study

We are currently studying the psychomotor development of a 7% sample of the cohort children. A team of psychologists is visiting 400 children at home and testing them with the help of the Griffiths Mental Development Scale, which has been adapted to Brazilian conditions. Six areas of development have been evaluated: locomotor, personal-social, hearing and speech, eye-hand coordination, performance (including fine motor skills), and practical reasoning. For each of these, a development quotient is calculated by dividing mental age by actual age. A global development quotient will be calculated by averaging all subscale quotients. The test has been extensively used for research in both developed and developing countries.

This part of the study will determine the magnitude of this important public health problem, by measuring the frequency and degree of psychomotor development delays. Development quotients for each of the six subareas will be related to perinatal factors and to nutritional status. Associations with socioeconomic, environmental, dietary, and parental factors will also be sought. The prevalences of developmental retardation will be calculated by using the third percentile of British children as the cut-off.

Data Processing and Analysis

All questionnaires were coded and entered on floppy disks, with dBASE III software. Linkage is ensured through the questionnaire number, which is the same for each child in all phases of the study. Data analysis is performed using IBM-PC-XT-compatible microcomputers, with the SPSS-PC+ package and the GLIM program for logistic regression analysis.

Financing

The project was financed, in its different phases, by the International Development Research Centre of Canada, and by the Overseas Development Administration of the United Kingdom.

Results

Maternal characteristics

During the perinatal phase, we studied the social and biological characteristics of the mothers, including their height and weight. It is interesting to note that such important information was not previously available for the city or the state and, as far as we know, this is the first population-based account of maternal characteristics in Brazil.

Table 2. Maternal characteristics by family income in Pelotas, Brazil, 1982 (n = 7392).

	Family income in minimum wages/month[a]					
Indicator	< 1	1-3	3.1-6	6.1-10	>10	All
Age	24.4	25.4	27.1	28.2	28.8	25.8
Parity	2.6	2.3	2.0	2.0	2.0	2.3
Antenatal visits	4.7	6.2	7.6	8.5	9.3	6.4
Schooling (years)	3.6	5.3	8.0	11.2	13.7	6.2
Smoking during pregnancy (%)	37.6	34.8	31.7	19.6	24.3	33.5
Height (cm)	155.0	156.3	157.6	158.4	159.6	156.5
Prepregnancy weight (kg)	54.6	55.9	57.0	57.0	56.6	55.9
Weight at end of pregnancy (kg)	64.9	67.5	70.0	69.9	70.4	67.7
Weight gain during pregnancy (kg)	10.5	11.4	12.8	13.1	13.3	11.8

[a] One minimum wage equivalent is equal to USD 55.

Biological, social, and health-care use characteristics of the total maternal population were disaggregated according to family income group (Table 2). Family income was used as a measure of socioeconomic status. One minimum wage is the monthly income of an unskilled worker and, in theory, should be sufficient to maintain a family of four. High inflation rates have, however, significantly affected its buying power and a minimum wage is now about USD 55. Compared with better-off groups, women from low family income groups were younger, shorter, weighed less at the beginning of pregnancy, gained less weight during pregnancy, had increased parity, were less well-educated, smoked more often during pregnancy, and attended antenatal care significantly less. These factors, among others not evaluated in this study, contributed to higher perinatal risk for these women (Barros 1985).

Child Care Indicators

Perinatal care

Detailed information was collected on type of delivery, on person undertaking delivery, and on reasons for caesarean sections or inductions. The maternal population was divided into three groups on the basis of risk, using a score system developed during the British Births survey (Chamberlain et al. 1978). The patterns of health care of women at different levels of risk were assessed.

This methodology uncovered a paradoxical pattern of health care (Barros et al. 1985; Barros, Vaughan, and Victora 1986). Of hospital deliveries, 61% were performed by doctors, with midwives and medical students being responsible for the remaining births. When pregnant women were divided according to risk, it was seen that doctors gave disproportionate attention to low-risk women, undertaking 70% of the deliveries in this group, compared to only 57% in the high-risk group.

Caesarean sections were performed in 28% of all births. There was a significantly higher proportion of caesareans among women at low risk (33%) compared to those at high risk (27%). Financial reasons seemed to affect the decision to perform a caesarean section; incidence increased markedly with family income, from 19% among mothers of the lowest income group to 47% among those of high income. Among other factors that have led to the high proportion of caesarean sections performed on high-income women, it is important to cite the common practice in Brazil of performing caesarean sections for tubal ligation purposes.

Child care

Information was collected on the number of attendances at well-baby clinics during the first 20 months of age, and on the proportion of children immunized with DPT, Sabin, and measles vaccines (Table 3). Although information on attendance at well-baby clinics may be unreliable, as it was based on mothers' recall of a 20-month period, the frequency of reported attendance is impressive, the most disadvantaged group showing a mean number of 9.2 attendances. This high level of attendance agrees with the high vaccine coverage that was checked through the children's immunization card. Overall, 83, 88, and 87% of the children were immunized with DPT, Sabin, and measles vaccines, respectively.

These results reflect the high coverage provided by health

Table 3. Health care use by children aged 20 months (12-27 months) according to family income, 1982-84 (n = 5229).

	Family income in minimum wages/month[a]					
Indicator	**<1**	**1-3**	**3.1-6**	**6.1-10**	**>10**	**All**
Attendances at well-baby clinics	9.2	10.2	10.7	11.8	12.0	10.3
Immunized (%)						
DPT (3)	72	82	89	94	95	83
Sabin (3)	79	87	94	96	96	88
Measles	80	87	91	96	95	87

[a] One minimum wage equivalent is equal to USD 55.

clinics in the urban areas of the city, where virtually all families have easy access to free health services. It is also a consequence of the recent emphasis given by the government to immunization campaigns.

The study also collected information on visits to specialists: psychologists/psychiatrists, dentists, ophthalmologists, otolaryngologists, and neurologists. This information is currently being processed. In addition, information was collected on clinic attendances for reasons such as incidence of diarrhea, and on hospitalizations, which will be discussed later under morbidity.

Child Health Indicators

Nutritional status

All newborns were weighed during the first 24 hours after birth. Unfortunately, it was impossible on that occasion to measure their length. Subsequently, in each follow-up visit the children were weighed and measured at home, with the help of portable length measurers and Salter-like scales.

The incidence of low birthweight (LBW under 2500 g) for all live births was 9% and, in this group, 40% were preterm and the remaining 60% were babies with intrauterine growth retardation. The incidence of LBW according to family income was 13% for those of the lowest income group and 4% in the highest income group (Barros 1985; Barros et al. 1987).

Weight and height were measured during the home visits in 1983, 1984, and 1986. The proportion of malnourished children below -2 standard deviations of the American National Center for Health Statistics (NCHS) median for children of different age groups were disaggregated according to birthweight (Figs. 1 and 2). There was a strong and long-lasting effect of birthweight on subsequent nutrition, with LBW children showing an increased prevalence of malnutrition. Among children who weighed 3000 g or more at birth, the prevalence of malnutrition was very low (Victora, Barros, Vaughan, Martines, Béria 1986).

Feeding habits - breastfeeding

The study collected detailed information on the feeding habits of the children. The questionnaire contained a large number of questions

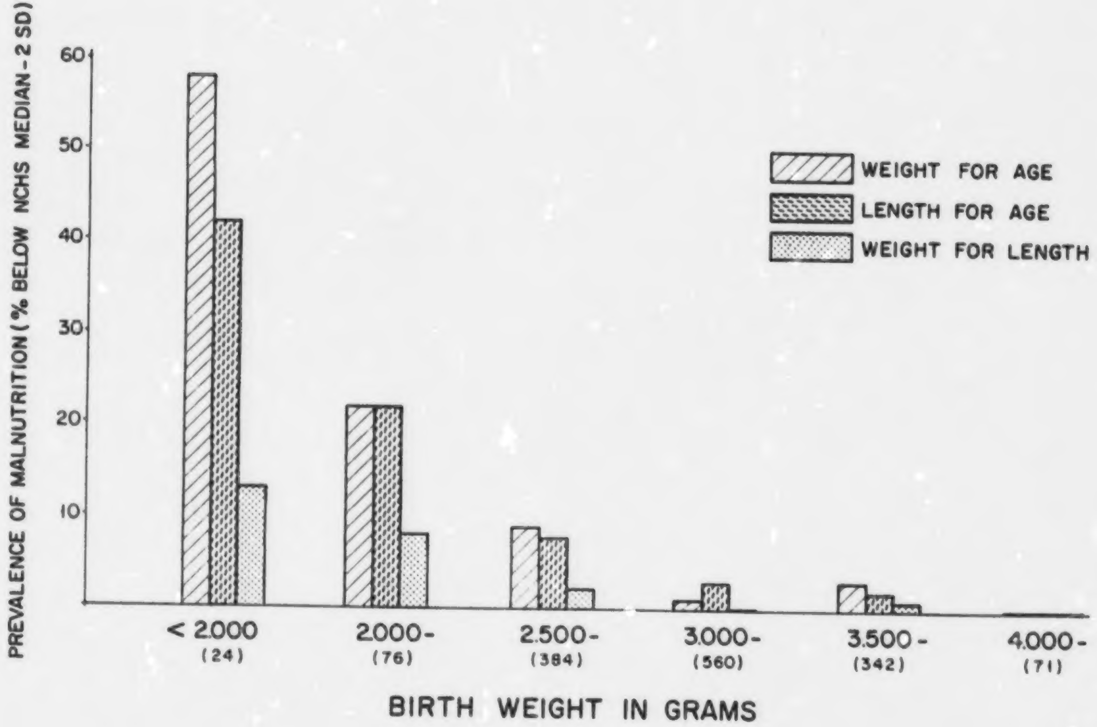

Fig. 1. Prevalence of malnutrition at 9-15 months according to birthweight, Pelotas 1982.

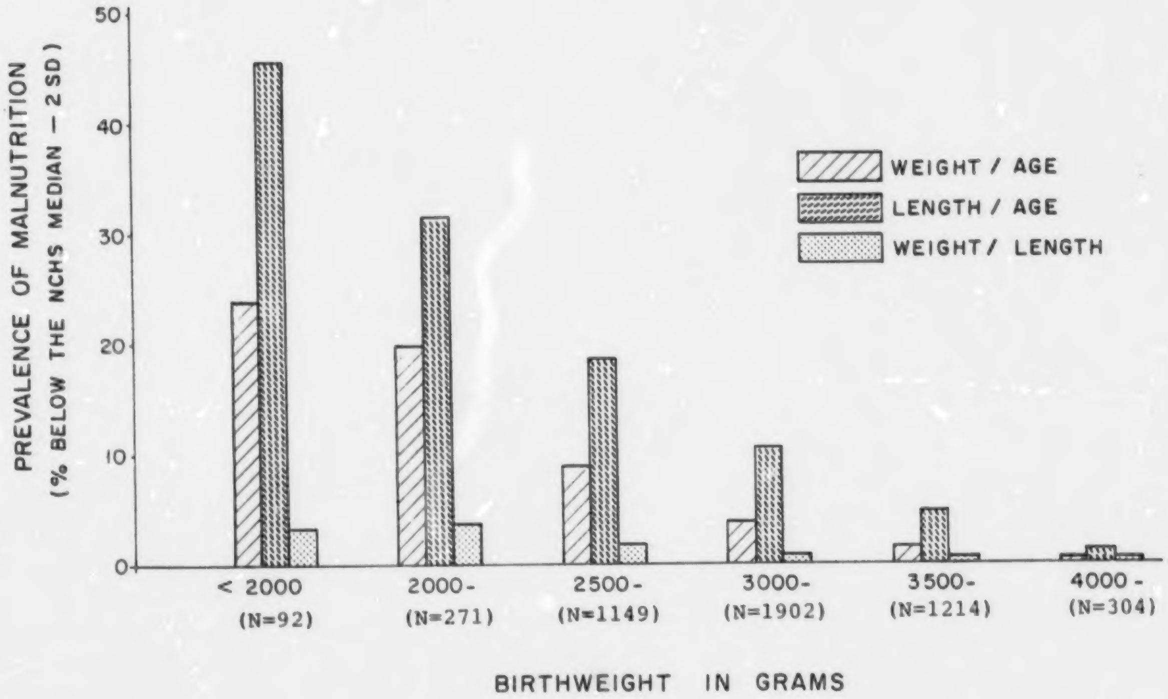

Fig. 2. Prevalence of malnutrition at 12-27 months (mean = 20 months) according to birthweight, Pelotas 1982-84.

on breastfeeding (including number of feeds, time of feeds, reasons for starting, stopping, or continuing breastfeeding), age of introduction of each supplementary foodstuff, and a complete 24-hour dietary recall.

The median duration of breastfeeding was only 3.28 months. Overall, 92% of the babies were started on the breast and, at the age of 3 months, 54% were still being breastfed. This proportion dropped to 30% at 6 months, 20% at 9 months, and 16% at 12 months.

There was a clear association between birthweight, socioeconomic status, and prevalence of breastfeeding. The proportion of babies commencing breastfeeding was higher in the richest families (97%) than in the poorest ones (89%) (Fig. 3). This trend was maintained at 3 and 6 months of age but, by 9 months, all income groups reported similar prevalences of breastfeeding. At 12 months, a different pattern emerged and the children of low-income families were more likely to be breastfed (21%) than those of the highest-income group (12%) (Barros, Victora, and Vaughan 1986). This pattern differs from that described for most developing countries, in which the poorest and less-educated families usually maintain a tradition of prolonged breastfeeding.

The prevalence of breastfeeding in the 1st week of life, and at 3, 6, 9, and 12 months of age, in babies of different birthweights is shown in Fig. 4. Of the babies weighing less than 2000 g at birth, 42% were never breastfed whereas, in all other weight groups, the proportions of babies started on the breast were over 90%. At later ages, the prevalence of breastfeeding increased with increasing birthweight. These differences persisted throughout the first year of life and were observed for the whole range of birthweights (Barros, Victora, Vaughan, Smith 1986).

It is clear from the above findings that a health priority in Southern Brazil is the promotion of breastfeeding for the groups at increased risk of early weaning, i.e., those of the poorest families and of low birthweight. Efforts need be made to increase the duration of breastfeeding to improve the chances of survival of these babies.

Morbidity

The following information on morbidity was obtained during the longitudinal study:

- episodes of diarrhea in the last 7 days;
- number of clinic attendances due to diarrhea and to other diseases;
- number and causes of all hospitalizations;
- presence of mental retardation, hearing, or vision difficulties; and
- occurrence in the last 12 months of the following problems: ear discharge, asthma, pneumonia, tuberculosis, urinary tract infection, febrile and afebrile convulsions, worms, intoxication with medicines inadvertently ingested, and accidents (burns and fractures).

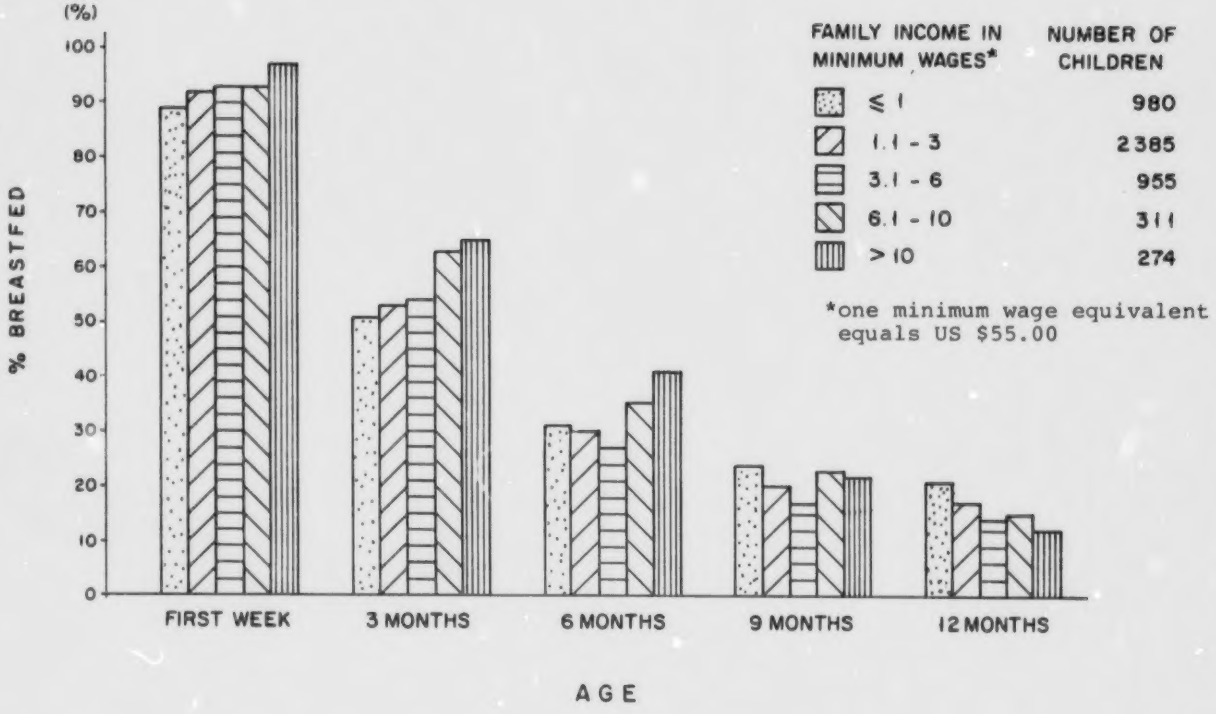

Fig. 3. Prevalence of breastfeeding according to family income, Pelotas 1982-84 (n = 4905).

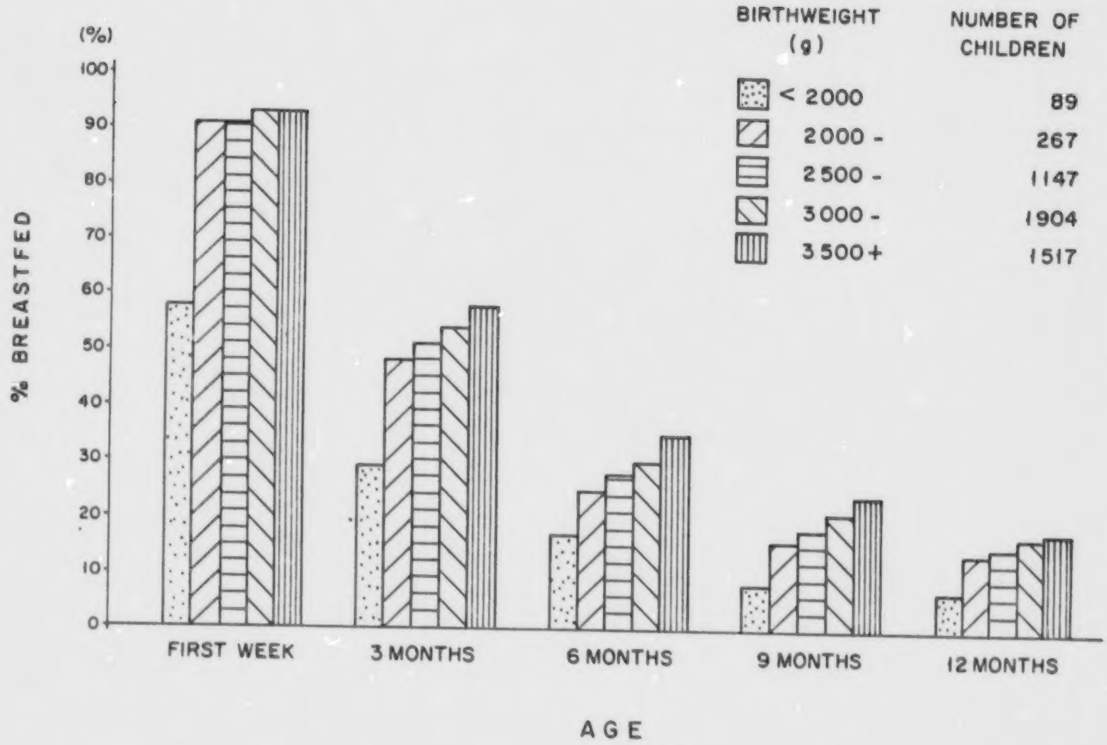

Fig. 4. Prevalence of breastfeeding according to birthweight, Pelotas 1982-84 (n = 4905).

With the exception of the information on hospitalizations that was validated by taking a sample of the questionnaires and visiting the hospitals to check if the children had really been hospitalized, the other questions on morbidity relied on recall and on the family's perception of the problem.

During the first 20 months of life, 28% of the children were hospitalized at least once. This proportion varied markedly according to family income, being 41% for the children of the lowest income families and 7% for those of the wealthier group.

Mortality

Several sources of information were used to identify deaths occurring among the cohort children. These attempts proved to be necessary, as we found an unexpectedly high proportion of underregistration, which reached 48% for stillbirths, 42% for perinatal deaths, and 24% for infant deaths (Table 4). Therefore, in southern Brazil, precautions must be taken when dealing with information on perinatal and infant mortality derived from official sources.

Table 4. Underregistration of perinatal and infant deaths shown by comparison of deaths registered at the secretariat of health with those detected by the longitudinal study, 1982-83.

Period	Registered deaths	Detected deaths	Underregistration (%)
Perinatal	132	228	42.1
Fetal	59	113	47.8
First week	73	114	36.0
Post-perinatal	111	128	13.3
Infant	184	242	24.0

Table 5. Perinatal mortality rates (per 1000 total births) according to birthweight and family income, 1982 (n = 7318).

	Family income (minimum wages/month)[a]				
Birthweight (g)	<1	1-3	3.1-6	>6	All
Less than 1500	756	694	615	875	720
1500-1999	204	235	214	200	219
2000-2499	76	105	132	97	98
2500-2999	20	19	4	14	16
3000-3499	23	14	4	-	13
3500-3999	11	7	15	4	9
4000 and over	36	22	-	-	17
All groups	48	33	23	18	34

[a] One minimum wage is equal to USD 55.

Perinatal mortality The perinatal mortality rate was 33.7 per 1000 births, and deaths were equally divided between the fetal and the early neonatal period (Barros, Victora, Vaughan, Estanislau 1987). Important differentials in perinatal mortality were observed when the families were studied according to birthweight and family income. Perinatal mortality was three times higher among babies of the lowest income group compared to those from families in the highest income group (Table 5). However, it seems that the influence of socioeconomic status on perinatal mortality was mediated almost entirely by differences in birthweight, at least for babies weighing up to 2999 g. For birthweight groups up to 2999 g, no significant differences existed in perinatal mortality for different income groups. The advantages of belonging to a high-income family, in terms of perinatal mortality, were only seen for babies weighing 3000 g or more.

These findings probably reflect the fact that there are many deficiencies in the perinatal health care provided for low birthweight babies, irrespective of their socioeconomic status. There are no intensive care units in the city, neither are there respiratory support, adequate laboratory and radiology facilities, and well-trained health personnel in sufficient numbers. Therefore, for small babies that need special health care, there is no advantage in belonging to a wealthy family, as this will not change the quality of care available.

Besides socioeconomic status, the perinatal study identified several risk factors for fetal, early neonatal, and perinatal mortal-

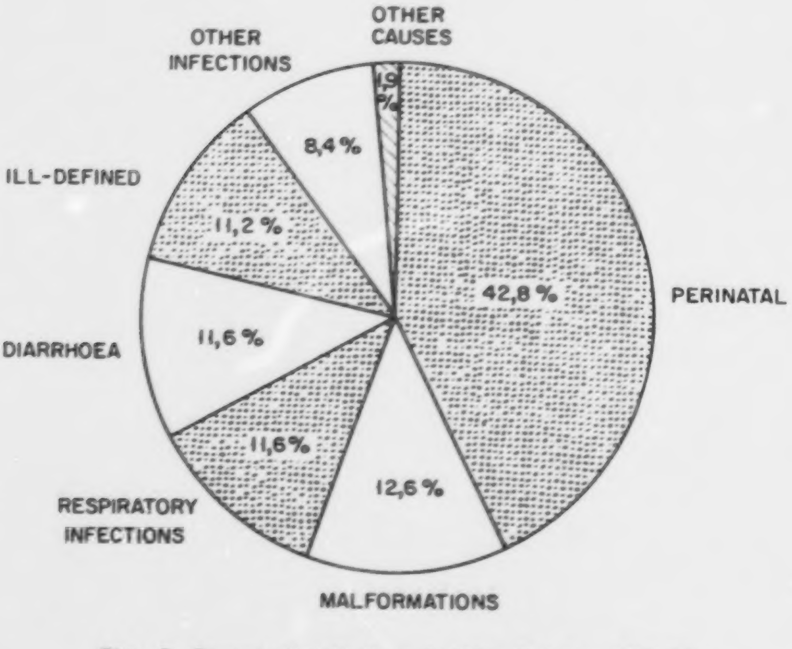

Fig. 5. Causes of infant mortality, Pelotas 1982-83.

ity that may be easily recognized by health workers in the first antenatal attendance to allocate pregnant women to the most appropriate level of care. The most important risk indicators are height below 150 cm, prepregnancy weight below 49 kg, age below 17 or over 35, and history of previous perinatal problems (abortion, stillbirth, or low birthweight).

Infant mortality There were 215 infant deaths among the cohort children, the infant mortality rate being 38.8 per 1000 live births. Perinatal causes accounted for 43% of the deaths and infectious diseases were responsible for 32% (Fig. 5). In this latter group, respiratory infections and diarrhea were equally important, each accounting for 12% of the deaths.

Of the infant deaths, 87% took place in the first 6 months of life, and this proportion remained very high (77%) even when only nonperinatal causes of death were considered. This suggests that preventive efforts should be concentrated in this period.

Birthweight and family income were important risk factors for infant mortality (Victora, Barros, Vaughan, and Teixeira 1987). The infant mortality rate was more than six times higher in the lowest income group than among families with the highest income, 87/1000 and 14/1000, respectively. Regarding birthweight, infant mortality was 10.8 times higher among children who weighed less than 2500 g at birth (232/1000) than among those who weighed 2500 g or more at birth (21/1000). The joint effects of birthweight and family income on infant mortality are shown in Fig. 6. For each birthweight group, mortality rates decrease with growing family income. On the other hand, within each income group, there were marked differences in mortality according to birthweight. In fact, in the lowest income group, the mortality rate for children weighing less than 2000 g at birth was 16 times higher than for those with birthweight of 3000 g or more. For the group with the highest income, the infant mortality rate was 100 times higher among children weighing less than 2000 g at birth than among those weighing 3000 g at birth (310/1000 and 3/1000, respectively).

These findings demonstrate that the effects of birthweight and family income on infant mortality are largely independent, and that birthweight is even more important, as a risk factor, than family income. Infants most at risk in the first year of life, i.e., those with low birthweight and belonging to low income families, need to be followed carefully by health workers; this should include home visits whenever necessary.

Conclusions

We have shown that it is possible to carry out a large longitudinal study of child health in a developing country, tracing a very high proportion of children (over 80%) in successive home visits. In places of high mobility it might prove easier to trace the children through a census rather than by the addresses obtained during the initial interview. The hard work, time, and money spent in a longitudinal study are compensated by the richness of the results. These studies offer the only opportunity to study the long-term effects of perinatal and early infancy factors on subsequent child health.

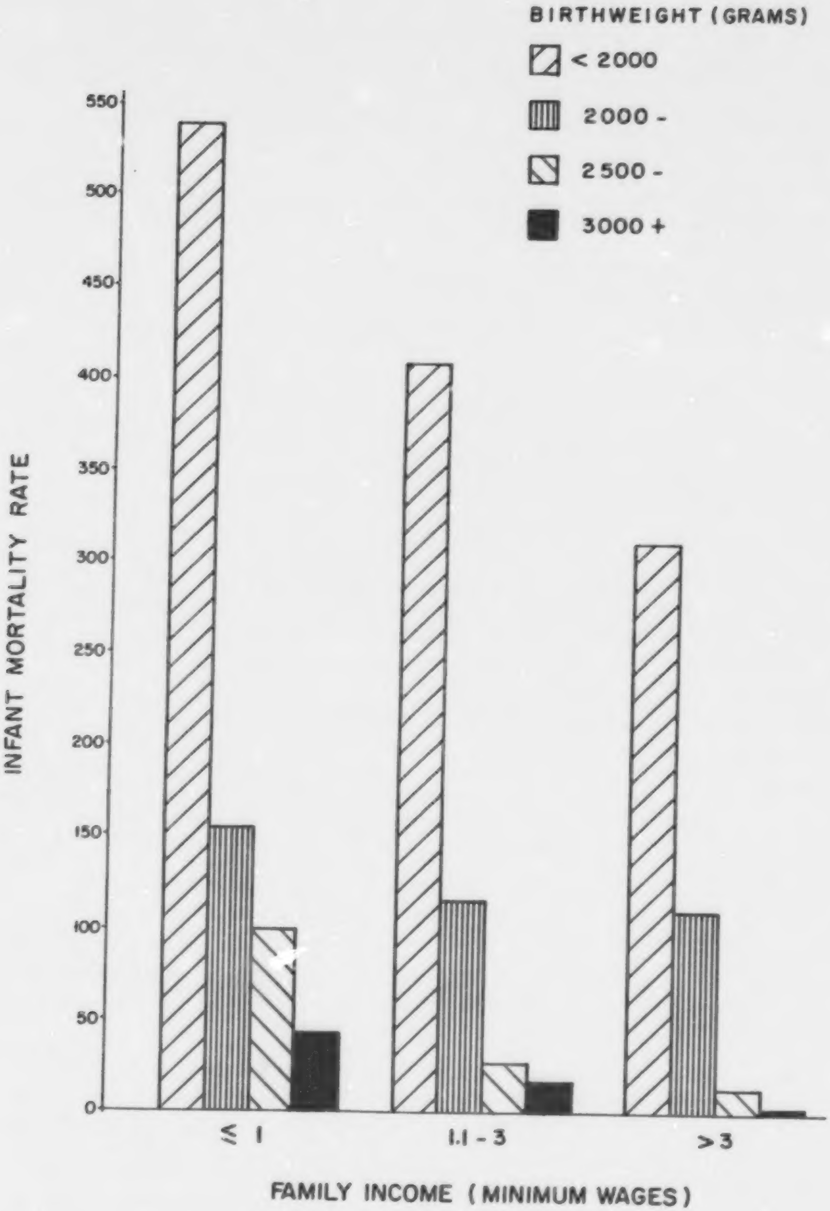

Fig. 6. Infant mortality by birthweight and family income, Pelotas 1982-83.

Although longitudinal studies of child health can produce important results in developing areas, there are situations when they can be replaced with advantage by other, more easily implemented, epidemiological methods. For example, for a survey of health conditions and health care, cross-sectional studies may be used. Special attention, however, must be paid to the representativeness of the studied population, without which the results can be invalidated.

Another useful method of epidemiological investigation, especially for morbidity and mortality, is the case-control approach. In such studies, cases of death (or disease) are studied retrospectively and, instead of comparing them with all surviving children, only a sample of the survivors (controls) with comparable characteristics are studied. The number of controls is usually two to three times that of the cases. The question of representativeness is also crucial here.

Epidemiological studies of child health and child care are necessary to increase our understanding of the factors determining disease and death. The choice of the most appropriate research method will depend on various factors, such as the objectives of the study, the study population, and time and budget constraints.

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ISSUES IN AN EXAMINATION OF THE RELATIONSHIP BETWEEN MATERNAL EDUCATION AND CHILD MORTALITY

Bamikale J. Feyisetan

Introduction

An interesting feature of the findings of studies on maternal education and infant/child mortality is the overwhelming predominance of a negative association between the two across cultures. In addition to results of cross-sectional and longitudinal analyses of data from many countries (for example, Adelman 1963; Shin 1974), a sample of case studies from Africa (Caldwell 1979; Farah and Preston 1982; Stephens 1984), Asia (Ruzicka and Kanitkar 1973; Bairagi 1980; Cochrane et al. 1980), Latin America (Carjaval and Burgess 1978; Haines and Avery 1978; Taucher 1979; Palloni 1981), United States and Europe (Chease and Nelson 1973; MacMahon 1974; Gortmaker 1979; Zabady 1981; Bross and Shapiro 1982) indicated an inverse relationship between maternal education and infant/child mortality. Some minor variations, however, exist in emphasis especially when infant mortality is broken into component parts (see, for instance, Niswander and Gordor 1972; Ruzicka and Kanitkar 1973; Palloni 1981).

Examining the relationship between maternal education and infant/child mortality with a view to determining the extent to which present findings conform with earlier ones is not the objective of this paper. Rather, the intention here is to review some of the underlying hypotheses that have been used to explain patterns of association between maternal education and child care, child health and, consequently, child mortality; evaluate the adequacy of different measures of maternal education that have been used in relation to those hypotheses; and highlight a procedure that can be used to determine the nature and relative significance of the different effects of maternal education, delineated by various intermediate variables, on child mortality.

Theoretical Issues

Discussion of the different ways through which maternal education can affect child care, child health and, consequently, child survival might continue as long as new intermediate variables were identified. In a similar manner, the difficulty of determining the nature of the impact of maternal education on child survival through any of the identified linkage variables may be appreciated when it is realized that some of the linkage variables may generate, simultaneously, contrasting effects on child survival.

In the literature, the impact of maternal education on child survival has been hypothesized to operate through several intermediate variables. One of these variables is birth interval. It has been suggested that because education is usually positively correlated with the use of contraception (see, for example, Cochrane and Zachariah 1983), maternal education tends to be positively correlated with birth interval that tends, in turn, to be negatively associated with infant and child mortality.

Maternal education has also been postulated to affect child survival through improved family relations. In discussions of female status, education is usually perceived to be one of the factors that can enhance women's status through a reduction of the culturally engendered sex inequalities in power, prestige, and control of material and nonmaterial resources, which usually favour men (see, for example, Mason 1984). Such perception is probably based on the notion that education is positively associated with social prestige and that female participation in nondomestic activities and, hence, their access to, and control of, material resources may be enhanced by increased education. Underlying the expected positive association between social prestige and female education is the belief that education widens female horizons. In addition, the proclivity to adopt "western" values is usually related to a woman's level of education.

A lot of discussion of the association between maternal education and infant/child mortality has, therefore, been built around the hypothesis that education alters the traditional balance of power in the family of procreation in favour of the woman with the consequence that she can take a more active part in decision-making. This line of reasoning forms part of Caldwell's explanation of the relationship between maternal education and infant mortality in Nigeria (Caldwell 1979). He contends that mothers with more education are less likely to be influenced by traditional practices inimical to health care; more capable of dealing with modern institutions; and able to alter the traditional balance of family relations to favour children rather than adults. His conclusion of a negative association between maternal education and infant mortality deserves to be qualified because infants of mothers with secondary education have higher mortality risks than infants of mothers with primary education. The need to seek additional reasons to explain patterns of relationships between maternal education and infant/child mortality is dictated by this finding.

In addition to the postulated impact of mother's education on the customary balance of power, on cultural attitudes about diseases, and on traditional practices (Maclean 1974), five ways through which mother's education can affect child health and, consequently, child survival have been identified by economists (Schultz 1984). First, it is hypothesized that the efficiency of health inputs used in the production of child health becomes enhanced with education (Grossman 1972). This hypothesis presumes that more-educated mothers will obtain greater benefits from health services and that higher female productivity would increase the demand for health services because the mothers' resources are increased for allocation to any or all activities. Second, perceptions about the best allocation of health inputs are hypothesized to be conditioned by education. In this case, more-educated mothers are expected to have healthier children because they are better informed about health-associated resources and are able to maintain health at a lower cost. Third, education may increase the total family resources. The contention here is that more-educated mothers have greater market resources even when they do not work in the market because, due to assortative mating, they tend to marry wealthier men. Such women are expected to spend more on child health and, thus, are expected to have healthier children. Fourth, more-educated women may assign a higher value to their own time, particularly if they work in the market and receive a higher wage rate. If, in such a situation, the mother's time is an essential "input" in the maintenance of health, then education could be negatively related to the health of the children. Lastly, education is hypothesized to affect the preferences for child health and family size (residually), given total resources, prices, and technology.

With the exception of the economists' fourth postulated causal link, the different ways through which education has been hypothesized to affect child health are suggestive of a negative association between maternal education and infant/child mortality. The economists' fourth channel of impact should be noted particularly for the relationship between maternal education and infant/child mortality in a transitional society such as Nigeria. With the growth of large commercial and industrial establishments and the increasing need for additional income to supplement the husband's income, increasing numbers of educated mothers are employees of establishments where children are not allowed. They, therefore, entrust child care to relatively inexpensive, unskilled housemaids whose services are sometimes unreliable. Where the negative effects engendered by such inadequate child care supercede the positive impact of education on child health via other intermediate variables, more-educated mothers may experience higher probabilities of infant death (see Feyisetan and Togunde 1986). Although inadequate child-care arrangements are related to conditions of formal employment, they have been discussed as indirect effects of education because the nature of employment is conditioned by level of education.

The effects of maternal education on infant and child mortality through other intermediate factors such as breastfeeding and the nutritional status of mothers and of their children are well known.

Measures of Education

Underlying the various hypotheses about the relationship between maternal education and child health and child mortality is the idea that differentials in education are related, inter alia, to differentials in attitudes to disease, to child-care practices, and to market opportunities. Such differentials are usually assumed to be reflected in the degree of rationality about diseases and their cure, in the quality of medical care offered to the children, and in access to or control of material and nonmaterial resources. An examination of the different ways through which maternal education has been measured is undertaken here with a view to assessing the adequacy of measures of maternal education that could be used to test empirically the ways in which maternal education is thought to influence child health and child mortality.

Data on maternal education have been obtained in several ways. For instance, in 12 of the 15 less-developed countries recently studied, data on maternal education were obtained by asking the respondent the highest level or grade, or the total years of schooling, she had completed. In the other three countries, questions were asked on the highest level or grade attained or attended. A summary of the four different ways of measuring maternal education is provided by Ware (1984): as a dichotomy between literates and illiterates (where literacy is defined in terms of the ability to read a simple letter in one's mother tongue); by number of years of schooling completed (preferably but not necessarily excluding repeated classes); by highest level of schooling attained (e.g., none, some primary, completed primary, some secondary); and by qualifications or degree obtained (no schooling, school leaving certificate, etc.). It was further suggested that the choice of a measure may depend on the purpose for which the data are to be used and local cultural conditions; and the working hypotheses as to how education is thought to influence behaviour (Ware 1984).

A critical examination of the different hypotheses reveals that, to have a major impact on child health and child mortality, education is expected to be a determinant of attitudes (belief systems) about diseases and their cure, about child care practices, control of material resources, and probably of social prestige that guarantee deeper communication between spouses. With respect to belief systems, more-educated mothers are expected to have less fatalistic views of diseases and, consequently, seek better medical treatment for their children. In relation to the control of material resources, education is expected to be positively correlated with generating income and, hence, with the quantity (and quality) of health inputs. Also, education is expected to be positively correlated with social prestige and, consequently, with female domestic power. The three features are related and are expected to operate simultaneously. For instance, an increase in social prestige may allow a woman to participate more in family decision-making with the consequence that she can take more independent decisions on the health of her children. To do this, however, she may need control over material resources to purchase adequate medical facilities and services for her children. What she purchases depends on her attitude toward diseases and their cure.

If education is expected to be related to child-care practices, control of material resources, and social prestige, the critical points in the educational system of each country that are likely to differentiate between groups of mothers with respect to these characteristics must be identified. Of first importance is identifying the different levels of education that symbolize variations in employment opportunities and, hence, in access to or control of material resources, and in social prestige. In that regard, a measure of educational qualification rather than of years of schooling may be preferred.

Even though significant differences in child mortality have sometimes been found using the literate/illiterate dichotomy, literacy, as it is usually measured, appears to be an inadequate measure of maternal education as far as a test of any of the hypotheses is concerned. This dichotomy ignores many variations in behavioural patterns. The mere dichotomy tends to overlook variations in determinants of child-care practices and child-care "time input," particularly among literates. The determinants include degrees of rationality, employment (or market) opportunities, and control of material resources, all of which vary among literates. In addition, there might be, among those classified as literate, those whose level of literacy may not be sufficient to produce a behavioural pattern different from that of illiterates.

The use of years of schooling, particularly the classifications adopted by several authors, may require modification in spite of the differences in child mortality that have been found to exist along those classifications. In a 1985 U.N. study, the following classifications were used for Nigeria: none, 1-3 years, 4-6 years, 7-9 years, 10-11 years, 12 years or more (U.N. 1985). If child-care practice is expected to be a function of attitude, of control of material and social resources, and of prestige (induced level of autonomy in the household), there will be little difference in child-care practice between, say, a woman with less than 4 years of schooling and her counterpart with no formal education. The same argument goes for mothers with 7-9 years and 10-11 years of schooling because, by the Nigerian standard, both groups are still in the secondary school group (barring the reporting of years spent in repeated classes). This observation may be true for other countries.

The use of qualifications obtained appears to be most appealing in the study of child care, child health, and child mortality because:

- qualifications indicate differences in the nature of employment opportunities and hence variations in child-care time input and in access to material resources;
- completing a well-defined phase in the educational system guarantees acquisition of a certain level of knowledge, in particular, that related to health (health-related subjects are usually given prominence in the last 2 years of primary and secondary school education in Nigeria); and
- social prestige, which may determine the amount of domestic power a woman possesses, is usually defined along lines of differences in educational qualifications and not along variations in the number of years spent in school.

The use of data on educational qualification appears adequate for the test of the various hypotheses because such data provide adequate insight into variations in attitude, in control of resources, in domestic power, and in child-care time input.

Data on literacy or years of schooling should still be collected in surveys but only to complement data on educational qualifications to be able to estimate fuller effects of maternal education.

Identifying the Predominant Effects of Linkage Variables

Several paths through which maternal education can influence child care, child health and, consequently, child mortality have been identified. Some of the intermediate (linkage) variables can produce, simultaneously, contrasting effects. For instance, employment condition can produce both positive and negative effects. Whereas the positive effects tend to operate through employment-generated income that is used to feed, clothe, and purchase medical facilities and services for the child, the negative impact may operate through inadequate child-care time, engendered by the competition between working and mothering for the woman's time. Which of the two contrasting effects predominates may be a function of the setting in which the study has been undertaken. In as much as the linkage variables, and hence maternal education, can generate contrasting effects, the nature of the dominant effect of a linkage variable on child health and child survival must be determined. The impact of an intermediate variable on child survival is assumed to be a reflection of its impact on child care and child health, each of which is positively correlated with child survival.

Using data from Ile-Ife, we provide a brief exposition of an approach that can be used to determine whether the impact of a conceptual linkage (intermediate) variable on child care, child health and, as a result, on child survival is positive, and whether positive effects of some linkage variables have prevailed over the negative effects of other linkage variables. This is necessary to determine if there are education-related factors that may reduce its stimulating impact on child survival. Once understood, suggestions could be made to minimize the operation of those factors.

The approach is based on an examination of changes in the initial difference between regression coefficients of two categories of education as variables depicting each identified path of influence are controlled. The procedure is undertaken in two stages. First, the pattern of child mortality risks that may reflect the direct and indirect effects of education is determined. This pattern is obtained by removing spurious effects of variables that could influence both maternal education and child mortality. Equation 1 (see Table 1) illustrates this stage because variables that could generate a spurious relationship between maternal education and child mortality were controlled. Once coefficients of dummy variables corresponding to the different categories of education are obtained, the difference between any two coefficients is noted. The application of this approach is illustrated with an examination of the patterns of change in the difference between coefficients of "secondary school completed" and "none/primary school uncompleted" categories. Some of the differences being examined are, unfortunately, not significant. Nonetheless, the results presented in Table 1 will be discussed. The difference (calculated as the coefficient of secondary education completed minus coefficient of none/primary school uncompleted) is referred to as the initial difference.

Second, the patterns of changes are examined in the initial difference as linkage variables are controlled. In our example, the lower educated group has a lower risk of infant mortality. As such an increase in the initial difference implies that the linkage variable being controlled would have operated to generate lower infant mortality risks among higher educated mothers had it been the only operating intermediate variable. The reverse is the case if the initial difference decreases with the control of the linkage variable. Coefficients of maternal education in other equations are compared to the coefficients in the first equation to determine the general pattern of change when the linkage variables are controlled.

Coefficients of maternal education in equation 2 depict a gain in infant survival among lower educated groups as variables of the environment were controlled. This pattern of change implies that

Table 1. OLS regression results relating maternal education to infant mortality controlling for different sets of variables.

		Mortality risks		
Equation and variables	Maternal education	First 6 months of life	Second 6 months of life	First year of life
1. Maternal age, education and employment, status of father, antenatal registration status, place of delivery	None/primary incomplete	R.C.	R.C.	R.C.
	Primary/secondary incomplete	-0.00415	-0.02577*	-0.02991
	Secondary	0.04603*	-0.03306*	0.02397
	Postsecondary	-0.00319	-0.02947	-0.03266
2. As in 1 plus variables of the environment: source and location of water supply, toilet facilities, refuse disposal system, cooker facilities, rooms occupied by family	None/primary incomplete	R.C	R.C	R.C
	Primary/secondary incomplete	0.00352	-0.02108*	-0.01756
	Secondary	0.04851*	-0.02389	0.02462
	Postsecondary	0.01506	-0.02092	-0.00585
3. As in 2 plus work situation of mother	None/primary incomplete	R.C	R.C	R.C
	Primary/secondary incomplete	-0.00718	-0.02584	-0.03302*
	Secondary	0.03116	-0.03192	-0.00076
	Postsecondary	-0.02030	-0.02808	-0.04838
4. As in 1 plus medical care variable: number of immunizations	None/primary incomplete	R.C.	R.C.	R.C.
	Primary/secondary incomplete	0.00835	-0.02041	-0.01170
	Secondary	0.04853*	-0.02883	0.02113
	Postsecondary	0.00810	-0.02294	-0.01422

continued

Table 1. Continued.

Equation and variables	Maternal education	Mortality risks: First 6 months of life	Second 6 months of life	First year of life
5. As in equations 1 to 4	None/primary incomplete	R.C.	R.C.	R.C.
	Primary/ secondary incomplete	0.00941	-0.01786	-0.00833
	Secondary	0.03572*	-0.02199	0.01514
	Postsecondary	0.00671	-0.01777	-0.01032

* Significant at 0.05 level.

environmental factors that are influenced by education generally lower mortality risks among more-educated mothers. The small increase in the difference between the coefficients of the two education categories being compared (from an initial difference of 0.04603 to 0.04851 in the first 6 months of life) is an indication of the relative insignificance of the stimulating impact of education through environmental factors.

The work variable is controlled in equation 3 and a reduction in infant mortality is discernible among less-educated groups. This pattern of change suggests that employment, highly determined by education, generally facilitates lower mortality risks among less-educated mothers. The size of the decrease in the initial difference between the coefficients of the two educational categories being compared (from 0.04603 to 0.03116 in the first 6 months of life and from 0.01296 to 0.00076 for the first year of life) indicates the relative significance of the depressing effect that the education-determined sector of employment may have on child-care time and consequently on child health and child survival.

Estimates of equation 4 indicate that education operates to lower infant mortality through the use of medical facilities. The small increase in the initial difference between the coefficients of the two education categories being compared (from 0.04603 to 0.04853 for mortality risks in the first 6 months of life and from 0.01296 to 0.02113 for mortality risks in the entire 1st year of life) indicates that the stimulating effect of medical care (at least as it is measured here) on child survival is not significant in this study area.

Finally, all identified linkage variables were included in equation 5. The result suggests the existence of some unidentified factors that may create a situation in which secondary education is associated with the highest mortality risks.

Our findings generally show that some of the factors associated with education could enhance, whereas the others could reduce, the probability of infant survival. In the Ile-Ife study, the negative impact of secondary education as associated with situation of work is stronger than the positive effects of better medical care and higher environmental quality.

Conclusions

In this paper, I have attempted to examine the adequacy of the existing measures of female education in relation to some of the hypotheses that have been used to link maternal education with infant and child mortality. In addition, I have given a brief exposition of a procedure that can be used to identify whether variables that symbolize an identified causal link have a positive or negative effect on child survival. It was also suggested that the procedure can be used to measure the relative significance of the different effects of maternal education. I applied this procedure to data collected on infant mortality from Ile-Ife, Nigeria. Results from the Ile-Ife study showed that the negative effects emanating from the nature of work usually assumed by secondary school educated mothers predominate over the positive effects that result from their more efficient use of medical facilities and better quality environment. This pattern may emerge in many less-developed countries as mothering and working become more incompatible unless adequate policy measures are adopted (see Feyisetan and Togunde 1986).

Much research is needed in the areas of data collection and model specification if the effects of education on child health and child mortality are to be fully and accurately ascertained. With respect to data collection, all behavioural inputs must be observed for each child: breastfeeding, nutrient intakes, use of medical services, among others (Schultz 1984). In addition, child-care practices among mothers in different work environments must be observed to determine differentials in quality of child care. It must be noted that education influences child mortality through some intermediate variables that are best measured biochemically or through in-depth interviewing or observation of behavioural patterns among a few respondents. An example is a mother's or child's nutritional status. Thus, data from large surveys may have to be supplemented by these methods.

With respect to specification issues, it is necessary to be cautious about making generalizations on the impact of education from a bivariate correlation. The impact of education should be independent of the effects of factors that could influence both education and child mortality (see Ware 1984:207). Spurious effects must be removed before attributing mortality patterns observed according to educational categories to the effects of education.

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MEASURING CHILD MORTALITY FROM MATERNITY HISTORIES COLLECTED AT TIME OF CHILDBIRTH: THE EMIS SURVEYS

Cheikh S.M. Mbacké

Introduction

Measurement is a fundamental aspect of research in the area of infant and child mortality. The evaluation of health programs requires, for example, a reliable measurement of the level of morbidity and mortality before and after the implementation of the programs. In sub-Saharan Africa, the measurement of child mortality is made difficult by the relative deficiency of vital registration systems. Most of the quantitative knowledge we have on mortality in this part of the world is achieved through demographic surveys. The objective of the EMIS surveys (Enquête mortalité infantile dans le Sahel) was to allow an in-depth study of child mortality using the survival of a sample of newborns over the first 2 years of life.

Since the first application of the methodology of these surveys in Yaoundé in 1978, it has become clear that, in many instances, because of the difficulties involved in the construction and follow-up of the sample, the current data collected by the follow-up survey might not yield reliable mortality estimates (Brouard 1985). For a detailed discussion of the methodological problems involved in the analysis of the current data, see also Fargues (1986) and Ouaidou and Van de Walle (1986). Because the EMIS involved so many methodological problems, corrections are needed at the stage of analysis. The use of retrospective data collected at the baseline interview is part of that effort.

The retrospective analysis is, however, complicated by the fact that EMIS data are of an unusual type for demographic analysis. Retrospective studies of fertility and mortality are usually based on reports from unconditional random samples of women, e.g., a cross section of the female population at a given time. The EMIS samples are of a different type: all women were interviewed at the time of birth of a child. This type of sample is referred to as conditional (inclusion is conditioned by delivery within the reference period).

The purpose of this paper is to present the methodologies for mortality estimation applicable to data from conditional samples. We first summarize the characteristics of such data. Then, the existing techniques are briefly discussed. A presentation of a new technique developed from the EMIS Bobodioulasso (Burkina Faso) data follows. The method is then tested with U.S. historical data. Finally, some implications for the collection of data on child mortality in sub-Saharan Africa are sketched.

Characteristics of Data from Conditional Samples

Data from conditional samples are affected by different types of biases. Some are specific to the data collection procedure - the way sample members are identified and interviewed - whereas others depend on the unusual timing of the interviews and are common to all conditional sample surveys, whatever the data collection procedure. The reference population from which the sample is to be drawn consists of all women who give birth in, say, a year. Sample members have to be identified and interviewed at the precise time of delivery. Identification and interview of sample members necessitate special procedures, the adequacy of which will determine the representativeness of the results. The easiest way to identify the sample is to use the existing civil registration and health systems. That is probably why almost all existing data of this kind were gathered through these systems.

The issue of representativeness raised here is, therefore, specific to the particular data collection procedure that is adopted. For example, the EMIS surveys (or more exactly, the urban versions) are biased toward women giving birth in the health centres. In most African cities, these are probably not representative of the female population giving birth.

Independent of the issue of representativeness are the biases generated by the timing of the interview. The proportions deceased among previous births to reporting mothers in Bobodioulasso show surprising results (Table 1; Fig. 1). We were expecting that, as is normally the case in unconditional samples, the proportions of previous births who died would increase steadily and predictably with mothers' age because exposure time is a function of the latter. Instead, they are virtually independent of mothers' age. In addition to possible errors in age and number of events reported, the flatness of the curve is probably due to three factors:

- reduced variation in exposure of previous children to the risk of mortality. In an unconditional sample, women are distributed randomly and continuously over the last birth interval whereas, here, they are concentrated at the end of it. Therefore, almost all previous children have been fully exposed to the high

Table 1. Proportions deceased by mother's age group for women giving birth between 1 April 1981 and 31 March 1982 in Bobodioulasso.

Age group	Number of women	Number ever born	Proportion deceased
15-19	1879	557	0.2585
20-24	2418	3779	0.2085
25-29	2090	7272	0.2094
30-34	1010	5520	0.2190
35-39	593	4290	0.2231
40-44	171	1478	0.2355
45-49	22	183	0.2568
All ages	8183	23079	0.2178

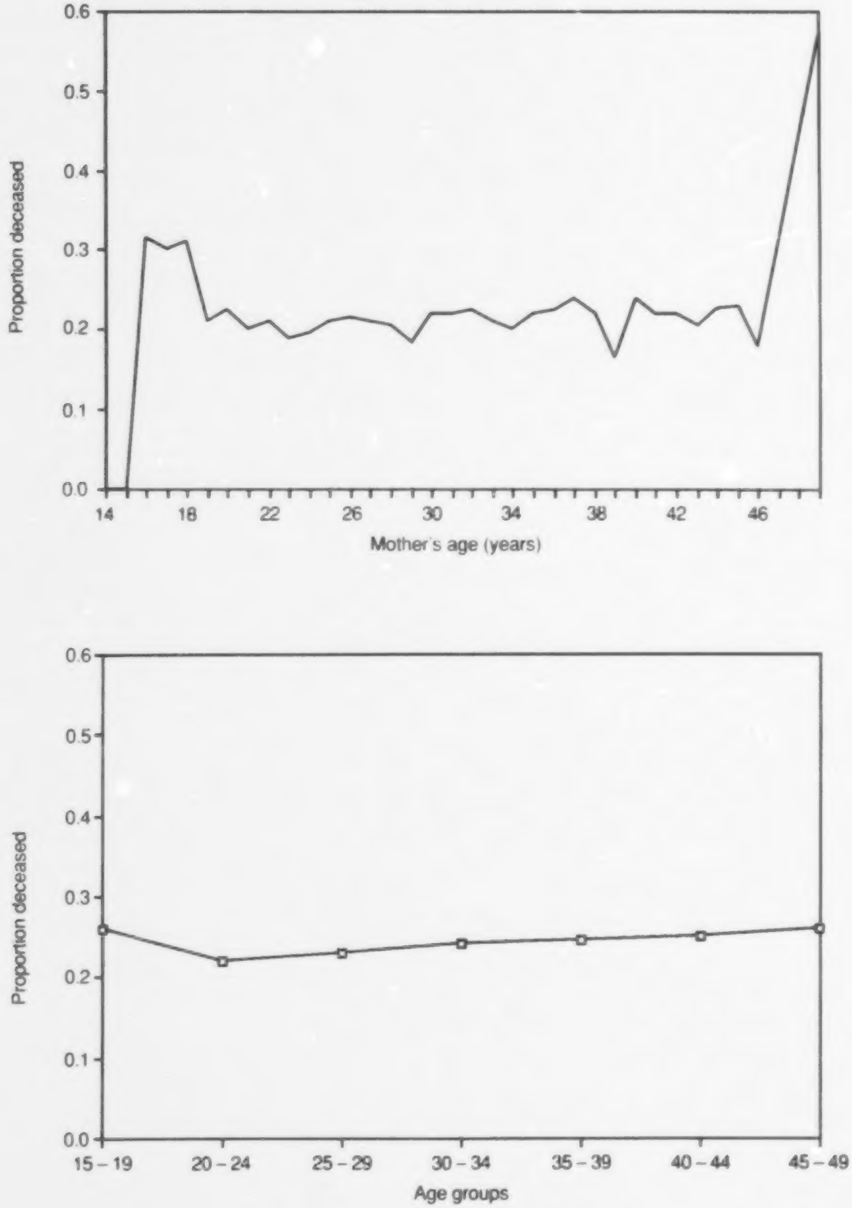

Fig 1. Proportion of deceased children by mother's age and age group for women giving birth in Bobodioulasso in 1981-82.

mortality risks of their 1st year. The variation in duration of exposure pertains to a range of ages where mortality is relatively low and changes with age less rapidly than during the 1st year.

- relative underexposure of children born to older mothers. The women who stopped childbearing are excluded and, for a given age of women, their children are, on average, older than those of older women who continued childbearing.

- selection of young women who lost their preceding birth. The proportions are noticeably higher for the first age group (Fig. 1). This reflects the higher risk of children born to teenage mothers but also another type of selection bias. Young women are included only if having a second or higher order birth. This is probably more common among those who lost their preceding birth. The proportion deceased for the first age group (and, to a lesser extent, for the second age group) is exaggerated by the fact that the preceding child is the only previous birth for most of these women.

The resulting effect of these three factors in combination with probable errors of age and the number of children ever born and children surviving is to yield a set of proportions that is virtually independent of mothers' age.

Techniques for Mortality Estimation Applicable to Conditional Samples

Brass's original technique for estimating mortality (Brass and Coale 1968) and its later versions (Sullivan 1972; Trussell 1975) have made available useful infant and child mortality measures for many developing countries despite the absence of dependable civil registration systems. The technique transforms the proportion of deceased children, for each age group of women, into probabilities of dying before specific ages. This robust technique is not applicable to data from conditional samples, e.g., samples of women having a birth within a definite period of time. Because of the timing of the interviews, the previous births (the child born at the time of the interview is excluded) are, on average, older than those represented in conditional samples. Three different approaches have recently been proposed.

Brass and McCrae (1984, 1985) propose two ways of estimating mortality with data from conditional samples. The Preceding Birth Technique (PBT) requires that one question be asked of women giving birth: "Is your preceding child alive?" (Brass and McCrae 1984). In populations where the mean length of the birth interval is close to 2.5 years, the proportion of last births who died, π, is shown to be a robust estimate of q(2), the probability of dying from birth to exact age 2 years. Contrary to what was suggested by an earlier paper (Mbacké 1986a), the approach is not directly applicable to EMIS data. The question asked in the EMIS surveys is slightly different from the one actually required by the technique. Instead of inquiring about the survival of the preceding live birth, the EMIS questionnaire asks the outcome of the preceding pregnancy. PBT can, however, be adapted to EMIS data. For a detailed presentation of the Adapted Preceding Birth Technique (APBT), see Mbacké (1986b:68-75). APBT gives a probability of dying from birth to exact age 2 years, q(2), of 133 per 1000 live births for Bobodioulasso in 1980.

The Adapted Multiplying Factor Technique (AMFT) requires, like the original Brass technique, knowledge of age, number of children ever born (excluding the current birth), and number surviving for each respondent (Brass and McCrae 1985). The technique is based on a hypothetical reconstruction of the unconditional from the conditional proportions deceased. This consists basically of adding a proportion of the current births (even if none have as yet been exposed to mortality) to previous ones to obtain the denominator used in the calculation of the proportions deceased. Application to the Bobodioulasso data yields unlikely results except for the estimate of q(5) (Mbacké 1986b).

Fargues (1985a) recognizes that, when women are interviewed at time of childbirth, the duration of exposure of previous births to mortality is a direct function of the mean length of the birth interval. He uses this property to estimate exposure time for each age group of women and takes the reported proportion deceased as being equal to the estimated duration of exposure. Application of Fargues' approach to the Bobodioulasso data yields the same estimate of q(5) as AMFT, does a better job than the latter above age 5, but does not "distinguish itself" at early ages (Mbacké 1986b). This is because, like AMFT, the approach does not provide for the fact (noted in Bobodioulasso) that children born to women aged 15-19 years and 20-24 years have higher mortality.

Brass and McCrae and Fargues assume homogeneous mortality that postulates that all previous births have experienced the same death rates. It has been demonstrated that, in Bobodioulasso, children born to women in different age groups have experienced quite different death rates. The proportions deceased for the first two age groups are not comparable with those reported by the other age groups. Even if mortality were not dependent on the age of the mother per se, the assumption of homogeneous mortality would still be violated because of the noted selection of younger women who lost their preceding child.

Partly because the proportions deceased by age groups are not comparable, any trends estimated from a comparison of the raw proportions would be biased. In fact, Fargues does not consider the effect that changing mortality will have on his estimates and does not provide a way of estimating trends. Brass and McCrae (1985) use the single estimate of q(2) given by age group 20-24 in successive years to estimate trends. That procedure is not possible with EMIS data that constitute a single-point observation. A technique allowing the estimation of mortality trends from these data is therefore needed.

A New Technique for Mortality Estimation

The new approach differs from the preceding ones mainly in the adopted grouping criterion: mothers are grouped by parity instead of by age. The idea of regrouping women by parity for the estimation of mortality is not new. It was suggested by Preston and Palloni (1978) for unconditional data. Until now, however, only age and marital duration have been used as grouping criteria. The major issue in choosing a grouping criterion is how well it controls for exposure time, the duration in which previous births have been exposed to the risk of mortality. In the analysis of data from unconditional samples, age and marital duration have proved their worth. For conditional samples, parity is a more appropriate grouping criterion. For each parity group, the range of variation of exposure time is narrowed down to the range of variation of the interbirth interval. The age or duration of exposure of previous births to the risk of mortality is a direct function of the mean length of the birth interval.

Estimating the Cumulative Probabilities of Dying

Consider the W_n women reporting n previous births. If the mean birth interval has remained constant and equal to I, then the age distribution of previous births is as follows.

Birth rank	Age
n	I
n-1	2I
n-2	3I
.	.
.	.
1	nI

The proportion deceased (d_n) is given by:

$$d_n = \frac{D_n}{nW_n} = \frac{W_n \delta_n}{nW_n} = \frac{\delta_n}{n}$$

where D_n is the number previous births who died and δ_n, the mean number of deceased children, is the same as estimated by Fargues (1985a).

$$\delta_n = q(0.8I) + q(2I) + \ldots\ldots + q(nI)$$

where the 0.8I comes from the estimation made by Brass and McCrae (1984) in the Preceding Birth Technique.

The problem is to determine the reference age, a_n, such that the observed d_n is equal to $q(a_n)$. This is achieved by assuming a model life table and applying the following procedure. We start by estimating δ_n^s and d_n^s that would be observed given the observed age and parity distribution if mortality was the same as the one used as a standard. The estimated value of d_n, d_n^s, is then situated in the set of $q^s(a)$'s of the standard and a_n determined by interpolation. The new technique is an adaptation of Fargues' approach to the situation where women are grouped by parity. (There are three versions of the new technique. For details, see Mbacké 1986b.)

Accounting for Nonhomogeneous Mortality Experience

Mortality is nonhomogeneous when children born to one or many groups of women have experienced mortality rates that differ nonrandomly from the population average.

Because of the higher mortality of first-born children, parity groups, where these represent a high proportion of all previous births, will present an excess mortality relative to other groups. To yield consistent estimates, the crude proportions must first be corrected. The solution used here is based on the more general approach for correcting Brass-type estimates provided by Ewbank (1982). Let R_1 be the relative mortality of first born and R_{2+}, the relative mortality of 2nd and higher order births. If P_1 is the proportion of first births in a year, then R_1 and R_{2+} are linked by the following relationship:

$$P_1R_1 + (1 - P_1)R_{2+} = 1$$

When women are regrouped by parity, the relative mortality of children born to either group will be a function of the proportion of these that are first births. For example, the proportion deceased reported by women with only one previous birth is not comparable with the proportion reported by women with five previous births. The lower n, the higher is the proportion of first births, and the higher the excess mortality. For women reporting n previous births, the proportion of first born is 1/n and the proportion of births of higher orders is (n - 1)/n. To make them consistent, the reported proportions are divided by K_n such that:

$$K_n = R_1/n + R_{2+}(n - 1)/n$$

Estimating Infant Mortality Trends

It is clear that "reports of cumulative events provide no direct evidence on trends in mortality or on age pattern of mortality" (Preston 1985). The set of q(a)s estimated by either of the techniques described above reflects both age pattern of mortality and mortality trends. If mortality has been changing, it will not be possible to disentangle these two aspects unless one is willing to assume that mortality follows a prescribed age pattern or unless one is able to specify the underlying trends (Preston 1985: 258). We have shown that, if mortality has remained constant, the assumption of a model life table is unnecessary (Mbacké 1986b). The proportion deceased reported by a given group of women would be equal to the probability of dying - in the current life table - from birth to exact age a_n, $q(a_n)$, where a_n is less than the mean number of years elapsed since the birth of these children. If mortality has been changing, the set of $q(a_n)$ estimates do not belong to the same life table. Feeney (1977, 1980) and Palloni (1980) have shown that, if cohort mortality has been falling linearly, then there is a cohort born C years before the survey to which the estimates under the assumption of constancy pertain. Mathematically, this correspondence also holds in the case where parity is used as a grouping criterion. However, as in the case of age grouping, to be able to identify the relevant cohort and subsequently to infer mortality trends, some assumptions about the age pattern of mortality are required. When the age pattern is unknown, we need to assume one. It is also necessary to assume that this age pattern remains the same throughout the period of interest. It is only under these conditions that variations in the probabilities of dying may be attributable to shifts in the mortality functions of the same model (Palloni 1980). In other words, one needs to assume a one-parameter model life table. Following these assumptions,

$$q(a,C) = q^s(a)*(K + rC)$$

where $q(a,C)$ = probability of dying by age a in the life table applicable to the cohort born C years before survey; $q^s(a)$ = standard $q(a)$ function in the adopted model mortality; K,r = parameters of the linear cohort mortality decline. For mothers reporting n previous births, we have:

$$d_n = \frac{B_1(K + rI_n)q^s(I_n) + B_2(K + 2rI_n)q^s(2I_n) + \ldots}{B_1 + B_2 + \ldots\ldots\ldots\ldots + B_n}$$

$$\frac{\sum\limits_i B_i(K + riI_n)q^s(iI_n)}{\sum\limits_i B_i} = \frac{\sum\limits_i B_i(K + rC)q^s(iI_n)}{\sum\limits_i B_i}$$

where B_i is the number of previous births of order i reported by women of parity n. Simplifying both left and right hand sides, we finally have:

$$C = \frac{\sum\limits_i iI_n q^s(iI_n)}{\sum\limits_i q^s(iI_n)}$$

C has the nice property of being independent of the parameters of mortality decline. C can be computed for each parity group. At any time C, we have:

$$\text{Logit}\ [q(a_n,C)] = \alpha(C) + \text{Logit}\ [q^s(a_n)]$$

where logit $[q] = 0.5 \ln[(1 - q)/q]$. Knowing $q(a_n)$ and $q^s(a_n)$, we can calculate $\alpha(C)$. We then use the relationship between $q(1)$ and $q^s(1)$ to calculate the infant mortality rate, experienced by the cohort born C years before the survey. Note that it is also possible to estimate any other value of the life table, $q(2)$ or $q(5)$, for example.

Application to EMIS Bobodioulasso

To apply the new technique, an estimate of the relative mortality of first born, R_1, is necessary. R_1 is estimated from the question on the survival of the preceding child. It is the ratio of the proportion deceased among first born to the proportion deceased among births of orders 2 and above. We have:

$$R1 = 0.1403/0.1158 = 1.21$$

This estimate pertains approximately to the first 2 years of life. It should be noted that it is affected by differences in the length of the first closed birth interval and higher order intervals. However, this correction is better than no correction at all. The set of K_n estimated for Bobodioulasso follows.

n	1	2	3	4	5	6	7	8	9
K_n	1.21	1.07	1.03	1.00	0.99	0.98	0.98	0.97	0.97

When data are not available for implementing the correction procedure, or when one is willing to lose some information, then it may be satisfactory to drop the two extreme parity groups and just work with the raw proportions deceased reported by parity groups 3 to 7.

Because of a relatively small sample size and errors on both the numbers of children ever born and children surviving, the proportions deceased by parity are not stable. They are smoothed using the following polynomial:

$$d_n = A + B\ln(a_n) + C[\ln(a_n)]^2$$

where ln stands for natural logarithm. This polynomial was chosen because, in all life tables that we tried, between ages 1 and 15, the q(a) function can be approximated by:

$$q(a) = A + B\ln(a) + C[\ln(a)]^2.$$

Note that smoothing is not necessary with large samples.

Comparison of Results

Despite differences in the approaches, all techniques give similar values for q(5): 205 for the new approach, 209 for Fargues', and 210 per 1000 for AMFT (Table 2). Compared to the new approach, AMFT and Fargues' technique give, in general, higher estimates before age 5 and lower estimates after that age (Fig. 2). The proportions deceased by age groups, d_x, are compared to the proportions deceased by parity, d_n (Fig. 3). The proportions deceased by age group are plotted at the group's mean parity. The proportions deceased for the different mean parities are interpolated between the observed proportions at exact parities 1 through 10. The d_x curve is too flat

Table 2. Estimated probability of dying, by age, using different approaches applied to the EMIS Bobodioulasso data (values per 1000).

Age	Follow-up	APBT	New[a]	AMFT[a]	Fargues[a]
1	88[b] (1983)	-	-	145	-
2	123[b] (1983)	133 (1980)	135 (1980)	186 (1980)	-
3	-	-	166	195	-
4	-	-	188	-	209
5	-	-	205	210	209
6	-	-	218	-	214
7	-	-	229	-	218
8	-	-	238	-	222
9	-	-	247	-	228
10	-	-	254	217	-

Note: Time location of estimates in parentheses when available.

[a] Model life table is African Standard.

[b] Source: Ouaidou and Van de Walle 1986.

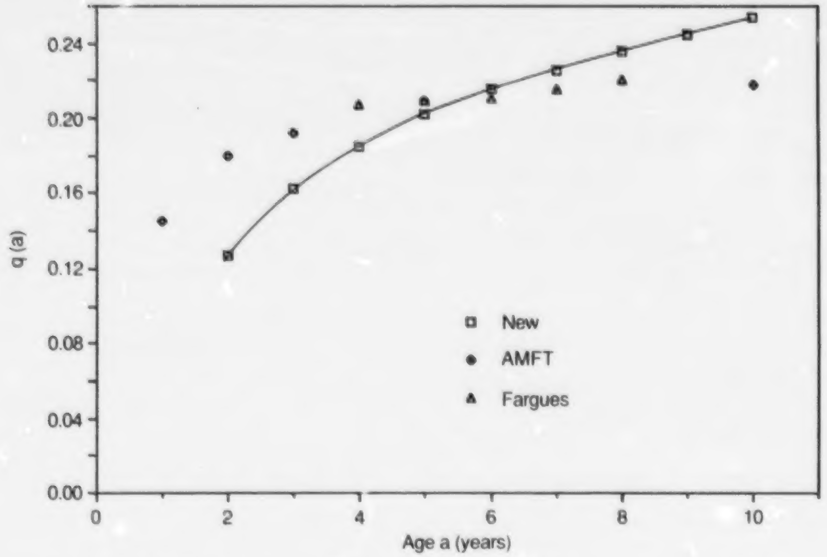

Fig. 2. Q(a) estimates under the assumption of constant mortality using different approaches.

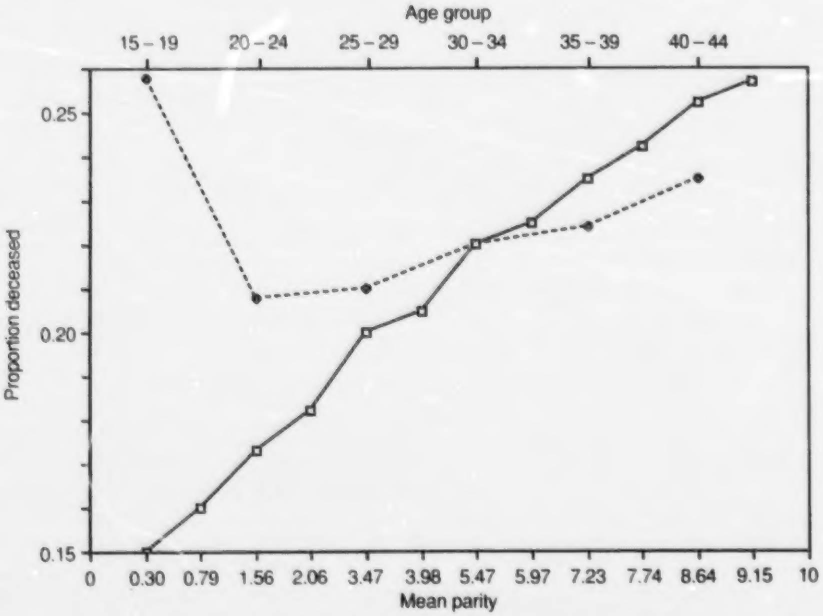

Fig. 3. Proportion deceased by parity (□) and by age group plotted at group's mean parity (●), Bobodioulasso.

relative to the d_n curve because of the three factors described earlier: reduced variation in exposure, exclusion of previous births to older women who stopped childbearing, and selection of younger women who lost their preceding child. Compared to results given by the new approach, the curves representing the sets of q(a) estimates given by AMFT or Fargues' approach are too flat in the image of the proportions deceased by age groups. If we consider the APBT estimate of q(2) as a reference (see Table 2), then we can say that the new approach performs better than the AMFT and Fargues' technique, at least when applied to EMIS Bobodioulasso. This qualification is necessary because the results produced by all techniques are necessarily dependent on the characteristics of the data set to which they applied. Therefore, the new approach needs to be tested on as many other data sets as possible before it can be generalized.

Infant Mortality Trends in Bobodioulasso

The results of applying the approach described earlier are shown in Table 3. These suggest that the infant mortality rate (IMR) has remained approximately constant between 1969 and 1974. A noticeable mortality decline is observed only after 1974. The pattern of decline from 1974 to 1980 is consistent with the estimate of 88 per 1000 for 1983 derived from the EMIS follow-up survey (Ouaidou and Van de Walle 1986). The constancy of the IMR between 1969 and 1974 seems also to be a genuine reflection of one of the most severe droughts in the recent history of the Sahel. The drought started in 1968 when, in some areas, rain fell 20% below normal and 30% or more below that of the 1950s (Caldwell 1975). It was only in 1974 that the region had some relief. Infant mortality trends for the three rural localities studied by Pilon (1982) also show a slight increase or constancy of the IMR from 1965-1969 to 1970-1974. The consistency of the rural trends with our estimates for Bobodioulasso suggests that both rural and urban areas suffered from increases in loss of life during the big Sahelian drought.

Application to U.S. Historical Data

Since the creation of the U.S. Birth Registration Area (BRA) in 1915, questions on children ever born and children surviving have been

Table 3. Infant mortality rate (IMR) in Bobodioulasso, 1968-83, per 1000 live births.

Year	IMR	Year	IMR
1968	122	1976	
1969		1977	110
1970	122	1978	104
1971	122	1979	-
1972	121	1980	96
1973		1981	-
1974	119	1982	-
1975	115	1983	88[a]

Note: Estimated from the EMIS follow-up data.

[a] Source: Ouaidou and Van de Walle 1986.

asked of all American mothers when a birth certificate is completed for each new birth. These data, which are essentially of the same nature as those collected through the EMIS (conditional data), were published on a yearly basis by the Bureau of the Census. They offer a good opportunity for testing the method. For details of the application to U.S. data, see Mbacké (1986b). We shall be limited here to a presentation of results. The data for 3 years are used to estimate trends in the IMR: 1919, 1924, and 1933. For these 3 years, the Bureau of the Census reports give the age and parity distribution of all women reporting a birth (U.S. Bureau of the Census 1921, 1926, 1936). They also give the distribution of reporting women by parity and the number of their previous births who are still alive. These tables allow us to calculate the proportions deceased by parity, the raw material for the method. The proportions of deceased children reported by white mothers giving birth in 1919, 1924, and 1933 reflect the mortality decline that occurred between these dates (Fig. 4).

The BRA population was undergoing major demographic changes between 1919 and 1933 (Table 4). During those 15 years, fertility and mortality declined noticeably. However, despite rapid fertility and mortality decline, the technique gives infant mortality trends that are comparable with the ones recorded by the Civil Registration System.

The infant mortality estimates are given in Table 5 and graphed in Fig. 5. The estimated trends are consistent with the observed infant mortality rates. Estimates based on reports of women who have only one previous live birth (circled in graph) are noticeably higher than other estimates when the same birth interval is used for all parity groups. This tendency reflects the fact that first borns have higher death rates than births of higher orders. The excess mortality of first borns is exaggerated by the flu epidemic in 1918. Note the similarity with what is generally observed for age group 15-19 years in the traditional Brass method (for example, see Feeney 1980). Note that the 1919 report imputes 10.5% of the decline in the IMR between

Table 4. Selected statistics for the U.S. birth registration area (BRA) in 1919, 1924, and 1933.

	1919	1924	1933
Number of states included	24	34	All U.S.
Total population (millions)	61.4	86.3	125.7
% of U.S. population	58.6	76.2	100.0
Crude birth rate per 1000	22.3	22.4	16.6
Number of white women giving birth	1,128,963	1,600,091	1,685,001
% of first born*	24.4	29.4	32.5
Mean number of ever born*	3.17	3.13	2.98
Recorded IMR per 1000*	83.0	66.8	52.8
Proportion of previous births who died*	0.1674	0.1449	0.1169
Estimated mean interval	2.18	2.41	2.36

Source: U.S. Bureau of the Census 1921, 1926, 1936.
[a] White population only.

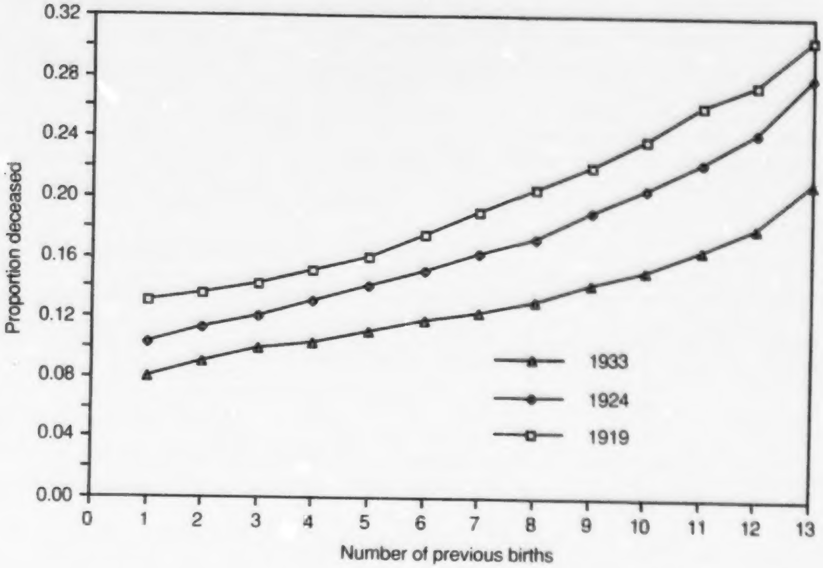

Fig. 4. Proportion of deceased children by parity for U.S. whites giving birth in 1919, 1924, and 1933 in BRA.

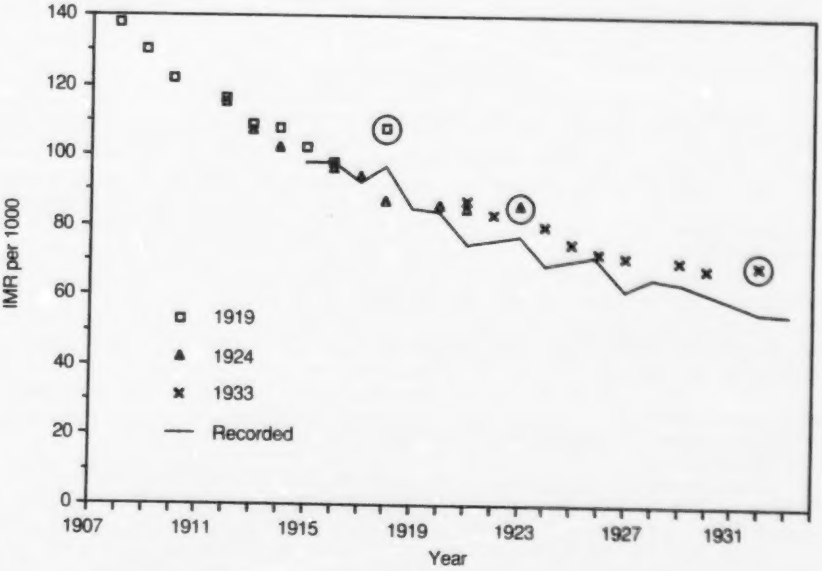

Fig. 5. Estimated vs recorded IMR for whites in BRA, U.S. 1915-33.

Table 5. Recorded and estimated IMR for the U.S. white population in the birth registration area, 1919, 1924, and 1933.

Year	Recorded IMR	IMR estimated from reports		
		1919	1924	1933
1908		137.3		
1909		129.6		
1910		121.9		
1911				
1912		116.7	116.2	
1913		109.1	107.5	
1914		106.2	102.3	
1915	99.0	102.5		
1916	99.0	99.1	96.2	
1917	91.0		93.1	
1918	97.0	106.8	87.7	
1919	83.0			92.8
1920	82.0		84.5	
1921	72.5		83.5	86.1
1922	73.2			80.7
1923	73.0		82.7	
1924	66.8			
1925	68.3			
1926	79.9			71.1
1927	61.0			68.2
1928	64.0			
1929	63.2			67.0
1930	59.6			64.4
1931	56.7			
1932	53.3			65.5
1933	52.8			

1916 and 1919 to the decrease in the proportion of first born. It is estimated that these first born had a mortality 33% higher than second born (U.S. Bureau of the Census 1921:20). Unfortunately, no information on the excess mortality of first born relative to all higher order births is available. Therefore, the method for accounting for the higher mortality of first born described in "Estimating the Cumulative Probabilities of Dying" is not applicable. It is clear, however, if estimates based on reports of women with only one previous birth are excluded, that the three series of retrospective estimates appear to be fairly consistent (Fig. 5).

Advantages and Limitations of the New Approach

The estimated mortality levels are determined mainly by the length of the mean birth interval. They are not sensitive to small variations in the length of the interval. The pattern of mortality trends is not at all sensitive to the length of the birth interval. Use of the values of 2 or 3 years produces noticeably different mortality levels but the pattern of trends is the same (Mbacké 1986b).

The estimation of the relative mortality of first born proposed for Bobodioulasso may not be reliable. R_1 is estimated as the ratio of the proportion deceased among first order preceding births to the proportion deceased among all preceding births. If the first closed interval is very different from the average for all orders, then our estimate of R_1 will be biased. For high fertility populations, however, the length of the closed birth intervals does not vary much with parity (Hobcraft and McDonald 1984). Depending on the data available, R_1 can be estimated more accurately.

In addition to making the estimation of mortality trends easier, a major advantage of the new approach is that parity is probably more accurately reported than age. Knowledge of age of respondents is not necessary for applying the technique. This makes the parity approach useful for estimating mortality from hospital records: the age recorded in hospitals' routine work is generally not reliable even if it is recorded.

Administrative Circuits as a Major Source of Demographic Data in Sub-Saharan Africa

One characteristic of EMIS is their high cost. Like most multi-round surveys, they are very expensive. As far as estimating child mortality levels and monitoring mortality trends is concerned, there are two possible alternatives to expensive demographic surveys.

Brass and McCrae (1984) show that inclusion of the question "Is your preceding child still alive?" in the birth registration form allows an easy and robust estimation of q(2). Hill et al. (1985) propose an additional question on the survival of the child born immediately before the preceding one. This additional question is expected to give a good estimate of q(5).

Another alternative is to use the large mass of data collected by the health care systems. Maternity clinics in many African countries have included in their routine questions to women who seek services information on the survival of previous pregnancies. We are certain that these data are available at least in Abidjan (Fargues 1985b), in Bobodioulasso (Mbacké 1986b) and in Bamako (Hill et al. 1985). In Bobodioulasso, the hospital records are of comparable quality to EMIS data and their substitution for the EMIS data would have yielded similar mortality estimates (Mbacké 1986b). The only additional cost of analyzing hospital records is copying the information in the registers onto files readable by computers. An improvement of the existing systems should be considered in the long term. However, because the number of questions that can be added to the routine questionnaire of the health and civil registration systems is limited (owing to a problem of overloading), this approach makes demographic surveys for the study of mortality absolete. An instructive study of mortality differentials necessitates, for example, more questions on the characteristics of the respondent and her household than can be included in the routine questionnaire.

A major problem with estimates from conditional samples is that they may not reflect the experience of the whole population. All existing data of this type are collected through the health or civil registration systems. In most developing countries, the coverage of these systems is far from complete. Therefore, the mortality estimates may be biased if the population excluded is different from the one covered by the systems. A possible solution to this problem would be to adapt the different techniques described in this paper to representative unconditional samples, such as those of WFS and DHS. This is theoretically possible when reliable maternity histories are available. One would need to identify mothers at the time of birth of their last child. The survival status of each previous live birth would then be determined and the conditional proportions deceased computed. This approach may be complicated by the usual difficulty of dating the birth and death of children who died. The experience is probably worth attempting because, in addition to direct estimation and the traditional Brass technique, all techniques described in this paper would be applicable to the same survey data. This would provide an unprecedented opportunity for evaluating simultaneously all these approaches.

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RESEARCH PROPOSALS AND PRELIMINARY FINDINGS

The ten papers whose summaries appear in this section were intended as working documents for critical discussion of research issues in the field of infant and child health in Africa. They represent a wide range of concerns from the policy and research priorities of a health practitioner (Gardiner) to the problems of and potential for multidisciplinary research in the field (Benneh, Orraca-Tetteh, Twumasi and Nabila).

The first paper, by Gardiner, identifies broad gaps in current research and emphasizes the necessity for future research to be integrated closely with the development of primary health care systems. The case is presented for operations or action-oriented research. The possible role of community participation in such research is the theme of the second paper by Ashitey and Netteh-Marbell who discuss a pilot study in the Suhum Kraboa/Coaltar District. Here, the authors acknowledge the problems associated with the present Civil Registration System in Ghana and propose an approach based on data collection through the cooperation of a health team, Vital Events Recording Assistants, and the general population.

The three papers which follow both critique and build on early research findings to suggest new approaches to research in infant and child health and mortality. Kandeh details the problems associated with the Correlates of Mortality Research Project associated with the University of Sierra Leone and proposes an approach that integrates large scale quantitative with more qualitative micro-scale research. Ubomba-Jaswa's previous research in an urban (Nsawam) and rural (Dobro) area of Ghana indicates the importance of considering cultural variables in research design and health intervention programs. Without this perspective, she argues, health services are frequently rendered ineffective. Yamuah's focus is on problems associated with the present health care program in the Gambia, specifically the recent Vaccination Compliance Survey, to develop an appropriate research design.

The papers by Iyun, Yumkella, and Jeng and Yamuah identify new research proposals. Iyun's, to be conducted in two rural areas (the guinea savanna Zone and the rain forest belt of Nigeria) represents a major attempt to incorporate ecological/enviromental factors and gender issues (the socioeconomic staus of women) into research design. Yumkella, recognizing the unreliability of data on infant and child mortality in Sierra Leone, outlines research to obtain information on mortality differentials and determinants. In common with Jeng and Yamuah's proposal for a mid-intercensal national demographic and health survey in the Gambia in 1988, Yumkella's particular concern is to identify a wide range of socioeconomic variables for inclusion in a questionnaire survey.

The two concluding papers by Benneh and by Benneh, Orraca-Tetteh, Twumasi, and Nabila are suggestive of the broad range of variables which must be included in any conceptualization of the nutrition and, hence, health problems among infants and children. In the first paper, Benneh discusses the relationship of nutritional level to land use patterns and food production systems in northeastern Ghana. The second paper presents the initial research design of a project conducted by a multidisciplinary team comprising two geographers, a sociologist, and a nutrition scientist whose objective was to assess the interrelationships among population, health, and nutrition. Particular emphasis was given to evaluating the relative significance of variables as they affect child health at the levels of the individual, household, and community.

Operations Research and MCH/FP Health Care Delivery

Charlotte N. Gardiner

To ensure effectiveness, primary health care systems, including MCH/FP health care delivery, must be constantly studied and evaluated. This research is most appropriate when conducted within the context of primary health care, incorporating the conditions of community participation, intersectoral coordination, and appropriate technology through operational/health systems/action-oriented research.

Current health service research in sub-Saharan Africa, as identified through WHO-sponsored activities, concerns three major issues:

- research into health systems organization. This includes development and testing of alternative patterns of organization and health care management emphasizing population coverage, continuity of care, effectiveness, and efficiency; development and testing of alternative concepts concerning the functions, levels, and training of health workers; and the improvement of health information systems;

- health technology adaptation. Few studies exist in this area, yet the need for simplification and adaptation of specific techniques as procedures is undisputed, as is the need for specific interventions appropriate to local circumstances and resources such as indigenous TBA kits;

- health status indicators, recognizing particularly the need to identify and quantify health status parameters to evaluate the impact of MCH/FP services.

Priority areas for future research have been identified by most sub-Saharan African countries as malaria, diarrhea, immunizable childhood diseases, malnutrition, and high maternal and perinatal mortality. In this context, the risk approach, which aims to focus special attention on those in greatest need within a framework of improved health care for all, requires investigation. Epidemiological studies are needed to identify risk indicators and levels of risk. These will form the basis for interventions which, in turn, should be tested by matching levels of risk with levels of resources. Two further areas are in need of investigation in a country such as Ghana. One concerns research into relevant approaches to education such as methods of selecting candidates for training in MCH/FP; methods of defining tasks for MCH/FP workers;

instruments for assessing performance; and methods of supportive supervision of field workers. Second, research is needed into health education, to find the most effective ways of educating the public about healthy life-styles; promoting public involvement in appropriate health action; and designing school curricula.

Constraints to operations research in MCH/FP include the lack of financial, material, and trained personnel resources and the lack of, and need for, community participation in problem identification and solution, a prerequisite of primary health care. This need for widespread involvement requires cultural reorientation away from nonquantitative attitudes toward critical, challenging inquiry and the scrutiny of evidence. Other constraints include the lack of involvement of intersectoral cooperation in defining problems and outlining solutions to health care problems; difficulties in transferring research findings into health service delivery; and the lack of a systematized health information network.

An Alternative Approach to Vital Events Registration in Ghana: the Suhum Experience

G.A. Ashitey and A.O.C. Nettey-Marbell

The present system of birth and death registration in Ghana is based on the compulsory but passive reporting of births and deaths by parents and relatives. For 1983, the estimated coverage of events for the country as a whole was 40% for births and 25% for deaths. But these figures hide gross disparities between south and north and between urban and rural areas with respect to completeness of registration. The lack of data makes it impossible to assess the impact of the recently introduced Primary Health Care (PHC) strategy. Although this problem is widely acknowledged and some attempts for improvement have been made in the past, none has had a far-reaching effect.

To test an alternative approach to vital events registration, a pilot study is being carried out in the Suhum Kraboa/Coaltar District, one of the initial 10 districts in Ghana selected to pioneer the implementation of PHC. This area, in 1985, had an estimated registration of births of 18%, and of deaths, 17%. Identified as a priority problem, the District Health Management Team set out to analyze the problem and search for a solution.

Shortcomings of the present Civil Registration System included a widespread lack of awareness of Act 301, the Registration of Births and Deaths Act; the inadequate provision of registration centres such that most of the population was not within easy reach of such facilities; bureaucratic "bottlenecks" in registration procedures that made registration inconvenient; a lack of commitment on the part of Assistant District Registrars; and the processing and analysis of data centrally at the Department of Births and Deaths (Ministry of Local Government), without feedback being sent to the district. As a result of this, those most in need of the data do not have access to it.

An alternative approach evolved as the PHC system became operative. The new system depends on three parties to obtain the data: the health team (HT), the Vital Events Recording Assistants (VERAs), and the general population. The health team in the pilot area was given the task of compiling a Register of Births and Deaths in their area, and 10 key villages were chosen as an initial target. Volunteers (interested residents, farmers, school teachers, traditional birth attendants) were recruited and given special training to become VERAs. Their prime responsibility is to collect details of all births and deaths. They record information on a daily basis for the village in which they reside. This information is collected each month by a member of the health team who checks the work, then enters the details in the vital events register. Data are validated both internally by cross-checking with monthly returns from midwives and traditional birth attendants (TBAs), and externally, through a survey to be conducted semiannually in two randomly chosen enumeration areas. The health team is encouraged to use the information in planning its work.

To achieve greater success, a public education program was introduced in early 1986, and in recognition of the vital role of VERAs and to maintain morale, a method of compensation for their work was to be reviewed in late 1986. Estimated coverage of births and deaths in the pilot area during 1986 was 72 and 32%, respectively.

Survey of Correlates of Mortality in Sierra Leone

H.B.S. Kandeh

This survey was the third in a series of mortality studies that had been undertaken by the University of Sierra Leone since 1977. The general objective of the Correlates of Mortality Research Project was to examine in greater detail the factors responsible for the high levels of infant and child mortality that had been revealed by the 1974 national census.

The specific objectives included:

- estimating infant, child, and adult mortality levels in the study areas to determine whether there had been any significant changes in the levels since the 1974 census;
- identifying demographic, social, economic, and environmental factors responsible for the existing levels and patterns of mortality;
- evaluating availability, quality, and user-effectiveness of medical facilities within the selected areas and the effect on mortality levels; and
- examining perceptions of mortality by respondents in the study areas.

The following relationships were to be examined:

- between maternal age, birth order, length of birth interval, and survival chances of infants and children;
- between environmental factors (type of water supply, facilities for sewage disposal, household sanitation practices, endemic diseases) and level of infant, child, and adult mortality;
- between household income, type of economic activity, availability,

type, quality, and distribution of food within the household, and level of mortality;

- between sociocultural factors (education, ethnic group, religion, cultural beliefs) and mortality;
- between use of traditional/modern medical facilities, treatment patterns for diseases, and level of mortality;
- between nutritional habits of mothers before and after weaning and probability of children dying in infancy.

The conceptual framework for estimating mortality included indirect techniques using summary reports of children ever born/surviving and maternity histories and direct estimation from a baseline survey and registration of births and deaths. Information from maternity histories was used to construct broad birth cohorts and probabilities of children dying between birth and certain exact ages of childhood in these cohorts based on the reported ages at death of deceased children within the cohort. For the analysis of the correlates of mortality, contingency tables were to be used to obtain proportions that would show variations in mortality levels by various characteristics. In addition, the Trussell/Preston technique for estimating the association between child mortality and various characteristics of the family, household, and community into which the children were born was used.

The study was designed to incorporate a quasi-anthropological approach in the estimation of mortality levels and the identification of mortality differentials. Data were collected in three phases: a baseline survey of households in June 1982; a registration of births, deaths, illnesses, and treatment patterns from August 1982 to July 1983; and a household survey from September 1983 to June 1984. In this final survey, three questionnaires were used: community level, household head, and women's (12-50 years of age).

Methodological problems in the area of data collection included the small sample size that restricted the number of vital events that could be recorded. For example, the baseline survey yielded 15,020 persons over 2000 households, and the registration survey recorded 578 live births and 328 deaths, of which 81 were infant deaths and 79 were deaths of children aged 1-4 years. Such small numbers pose problems for the examination of mortality differentials. The cost of registration for such a small number of events was also high because the study areas were located a great distance from the project headquarters and were visited every month for the collection of completed questionnaires. Linking the various data sets to explain the estimated levels by the information on differentials collected from the household heads' questionnaire as well as from the women's questionnaire was also a problem. These last two questionnaires elicited information on perceptions about death in terms of whether individuals could explain why there were frequent deaths of infants and children and whether anything could be done to reduce such deaths. The results were disappointing because information was being collected by interviewers who were not particularly concerned about the issues. Success is more likely to have been achieved had the principal investigators carried out the interviews themselves. In addition, problems were associated with the bulky nature of the questionnaires used in the household survey, as they tried to obtain all the information listed in the research objectives.

Problems with the conceptual framework in relation to the estimation of mortality levels revolve around the appropriate model life table to be selected as this affects the estimated infant mortality rate. For example, in the case of Sierra Leone, the infant mortality rate obtained from the 1974 census results ranged from 206 to 241 depending on whether the South, North, or West family of model life tables was used. The study also failed to explain regional differences in mortality levels in terms of differences in social, economic, and environmental variables that were similar for most of the communities because they were largely rural.

Suggestions for future research include action-program oriented surveys to assess their impact on infant and child mortality, and micro-approaches to enable a more realistic conceptual framework to be formulated.

Culture and Health: Lessons from Data Collection on Child Health in Ghana

S.R. Ubomba-Jaswa

Many intervention programs and projects, which aim to reduce high levels of infant and child morbidity and mortality, are implemented without adequately considering people's beliefs and attitudes toward health issues. Thus, it is not surprising that health services may be underutilized, health and nutrition instructions may be ignored, and immunization programs shied away from.

With the aim of identifying more clearly the relationship between cultural values and child health practices, research was conducted in the urban district of Nsawam (population 31,900 in 1984) and the rural area of Dobro (population 679 in 1984) in Ghana during the first half of 1986. The specific objectives of the research were:

- to establish mothers' level of knowledge and use of health services;
- to ascertain maternal attitudes and beliefs on preventive health measures;
- to identify child eating patterns;
- to identify patterns of child disease; and
- to gauge maternal perceptions on childhood mortality.

The research was based on a household sample survey in which mothers aged 15-45 years who had had at least one live birth in the past 10 years were interviewed. A questionnaire comprising both structured and unstructured questions was used to collect basic data. In addition, in-depth interviews were conducted with health workers in government-run child-welfare centres, in well-baby clinics, and nutrition-demonstration classes. Markets were visited to find out how mothers combine work and child care. Observations of child-care practice were recorded as the questionnaires were administered.

Issues that arose from the research included:

- Choice of fieldworker. The sex and age of the fieldworker, whether recruited from the community under research or from outside, and whether from the field of health or social work or from another field were considered critical variables in the selection process.

- Necessity of prior knowledge of a group's culture in constructing a questionnaire to obtain the answers sought from the questions asked. The local classification of disease is particularly significant here. For example, respondents in the survey area did not consider diarrhea in a child under 1 year to be an illness; it was viewed as part of the teething process.

- Reflection of cultural values in responses to the questionnaire. In this context, responses to general questions must be probed to identify more precisely the role of cultural factors. For example, in addition to questions on the duration of breastfeeding and whether it is full or partial, questions such as why mothers breastfeed, how they measure an infant's satisfaction, and how they ensure adequate nutrition for themselves, should be pursued.

- The benefit of combining different data collection methods. During the survey, in addition to questions on weaning practices, observations were made and data collected on household cooking and eating patterns, for example. In this way, a more complete picture of childhood nutrition could be obtained.

- The relationship between low acceptance and high drop-out rates from immunization to the ineffectiveness of measles vaccine.

Infant Mortality and Second-year Death Rates in The Gambia, 1973 and 1983, and a Vaccination Compliance Survey

M. Yamuah

In the 1970s, the Gambia had one of the highest infant mortality rates in Africa, 217/1000 in 1973. It had dropped to 160/1000 according to the 1983 census, but remained very high. During this same period, the 2nd-year death rate dropped from 68 to 41/1000. Infant and child mortality remains an area of central concern to public health officials and the focus of attention of the Primary Health Care (PHC) program.

In this context, the present research aimed to discuss mortality differentials to identify the determinants of mortality; to illustrate some problems that hinder rapid health improvement in the Gambia; and to discuss the methodology of a Vaccination Compliance Survey as a basis for future research.

On the basis of indirect estimates from census data and longitudinal studies conducted in the Gambia, educational, regional, and religious differentials are discussed. The arguments support the view that mothers' education plays an important role in child health as it brings awareness about health hazards and preventive medicine. In 1983 in the Gambia, only 14% of females over age 10 years were literate; evidence suggests that the high degree of illiteracy explains in part the high infant and 2nd-year mortality rates.

Analysis of longitudinal studies conducted in the Gambia indicate that malaria, malnutrition, and diarrhea act synergistically to affect infant and child health and mortality. As a result, they prove to be more intractable to health-care intervention than diseases against which children may be vaccinated under the PHC program.

To assess the variables influencing the PHC vaccination program, in 1985, a Vaccination Compliance Survey was conducted in Bakau and Sukuta, two urban centres within 20 km of Banjul. Its specific objectives were to assess the relationship between maternal education and clinic attendance; to determine mothers' knowledge of the diseases against which their children were being immunized; to establish the reasons for visits to the clinics; to obtain data on fertility and mortality; and to estimate the socioeconomic status of families that visit the clinic.

Five hundred women with children aged 12-18 months were chosen for the initial survey, being differentiated according to vaccination record and regularity of visits to the clinic. A questionnaire was administered to these women. Initial results indicated that level of education is associated with knowledge of disease and that visits to the clinic were associated with illness of a child rather than a check up or weighing.

Infant and Child Mortality, Environmental Factors, and the Socioeconomic Status of Women in Two Rural Centres in the Western Part of Nigeria: A Research Proposal

Folasade Iyun

Most of the available studies on infant and child mortality have concentrated on identifying the killer diseases (the biomedical approach) and the socioeconomic factors that influence mortality (the demographic approach). The latter's major concern has been the important role played by maternal education in giving rise to differentials in infant and child mortality.

The present research is inspired by an attempt to apply spatial dimensions - the geographical perspectives - to research in infant mortality so as to identify the contribution of environmental conditions and develop suitable interventions and strategies to solve this problem. This is particularly important as Primary Health Care (PHC) is now the focus of Nigeria's health strategy. The broad objectives are to assess the relative role of environmental conditions in the morbidity and mortality rates of children; to evaluate the influence of mothers' socioeconomic status; and to develop and test a methodology for carrying out this type of research.

The specific objectives of the research are: to estimate early childhood mortality levels for the two rural centres chosen for study; to identify the major diseases or illnesses responsible for infant and child mortality; to investigate local knowledge, attitudes, and practices concerning prevention and treatment of these illnesses; to assess the nutritional status of children and feeding behaviour of mothers; to assess the relative role of environmental factors (access to potable water, waste disposal, housing conditions); and to evaluate the influence of mothers' socioeconomic status on infant and child mortality.

The conceptual framework of the research is based on the ecological (geographical) approach that assumes that certain environmental constraints predispose children to certain diseases and, therefore, bring about spatial differentials in health and death. The study hopes to identify common childhood diseases that cause greatest mortality and find out how they relate to environmental and socioeconomic factors. Within this context, the specific hypotheses to be tested include:

- that the magnitude of the major common diseases and those causing the highest mortality are determined by regional differentials in geographic characteristics: upland and sand terrains, housing conditions, access to potable water, waste disposal;

- that the nutritional status of children under 5 years, as indicated by anthropometric measurements, is determined by sources of food supply and socioeconomic characteristics of mothers;

- that different age groups of children carry differential risks of morbidity and mortality of common diseases;

- that education, income, and occupation of mothers are the most important explanatory factors of morbidity and mortality rates despite intra- and interregional environmental differences; and

- that maternal education is the most important factor in terms of control measures (immunization) and medical care sought.

The two rural centres selected for the study are located in the guinea savanna zone (Omi-Adio, near Ibadan) and the rain forest area (Igbokoda, in southeastern Ondo State). An observational study of the general geographical characteristics of the area in respect of terrain, soil, housing structure, and settlement pattern will be carried out. This will place environmental factors in their spatial perspective. All all women aged 15-49 years will be interviewed and complete maternity histories will be collected. Information on socioeconomic status will also be requested. Childhood mortality will be measured both indirectly, on the basis of data on children ever born and total surviving children of women interviewed, and directly, from reported deaths of children born since 1979. Information on morbidity will be obtained from the interview survey of women and from formal discussions with local key informants (traditional healers and modern health workers). Available records of medical institutions in the two areas will also be examined. Anthropometric measurement of all children ages 0-5 years will be made to assess their nutritional status. Finally, selected in-depth interviews, including focus-group discussions, will be conducted to probe more deeply into feeding practices, child care and management, illnesses, and child death. The combination of methods proposed will be complementary and, in some instances, act as a cross-check. On the basis of past experience, female interviewers will be used, if possible those with work experience in the health field.

The study is expected to bring spatial perspectives into this type of research to identify the most vulnerable groups and area units. Such findings may act as signposts to formulate an appropriate health strategy for rural dwellers in Nigeria.

The Determinants of Infant and Child Health and Survival in Sierra Leone: A Research Proposal

Fatu Yumkella

Against a background of considerable doubt as to the reliability of previous assessments of infant and child mortality in Sierra Leone (for instance, the IMR was variously estimated as 227/1000 from the 1974 census, compared to a figure of 183/1000 from a survey conducted by H.B.S. Kandeh in four districts), a research proposal is outlined with the following objectives: to obtain levels of mortality in Sierra Leone and regional, urban-rural, and socioeconomic differentials; to deduce the principal causes of death; to establish the major determinants of infant and child mortality; and to relate the findings to prescriptions for change.

A questionnaire to be administered at the household level to mothers aged 12-50 years is to be the basic tool for the collection of data. The sample of 5000 households represents about 1% of the population and is to be distributed among Freetown (13.3% of the sample households), other district headquarters (9.3%), other urban centres with a population over 2000 (9.3%), and rural areas (68.1%).

The questionnaire, divided into modules, includes demographic information (date of birth, education, religion, ethnic group, occupation, husband's background); respondent's background; community size; maternal history; nutrition; health status and causes of death; and community level factors (type of settlement, accommodation, ecological environment).

The IMR and CMR will be measured by the direct method of computing data on deaths in the 2 years previous to the survey and through indirect means. Infant and child mortality will be estimated on the basis of children ever born and children surviving. Multivariate techniques will be used to analyze the determinants of infant and child health.

Infant and Child Health in The Gambia: Overview of a Research Proposal

M.S. Jeng and M. Yamuah

Infant mortality rates, estimated at 160 per 1000 live births from data collected during the 1983 census, remain high in the Gambia. In fact, mortality differentials for infants range from 92/1000 for the capital, Banjul, to 205/1000 for Basse Local Government Area, according to 1983 data. Against this background and attempts by the Primary Health Care program introduced in 1980/81 to improve health, the Department of Statistics is planning a midintercensal national demographic and health survey for 1988.

The overall objectives of the survey are to provide an estimate of the total population and its demographic and health characteristics; to provide data for the estimation of births, deaths, migration, and population growth rates; and to analyze, interpret, and publish the data to assist planners, policymakers, and researchers.

A questionnaire is proposed as the basic methodological tool for the survey. Questions will focus on the health and mortality experiences of infants and children, their mothers' socioeconomic status, and children ever born. Specific questions will concern age of mothers, marital status, ethnicity, nationality, education, economic activity, data on births in the previous 24 months, survival status of births in the last 24 months, proximity of mother's residence to a health centre or clinic, place of delivery of births in last 24 months, number of children ever born and number dead, birth interval, breastfeeding habit, immunization, nutrition status, and use of health centres or clinics. If the draft questionnaire proves to be too bulky, basic information only will be obtained from the entire sample, and a subsample will be identified for in-depth data collection. The initial questionnaire with retrospective questions will be followed by a multiround survey to be repeated at 6-month intervals for 2 years, through which direct measurement of infant and child mortality will be obtained.

A sample size of 5% of the women (i.e., 12,500 to 13,000) in the reproductive age group would be covered within selected clusters. They will be drawn from the entire country and selection will be based on a systematic sampling procedure with probability proportional to size. The list of settlements compiled during the 1983 Population and Housing Census would provide the sample frame.

Population, Food Production, and Nutrition in a Northern Savannah Village of Ghana

G. Benneh

In Ghana, nutritional surveys have been carried out that examine nutritive values of food eaten in different parts of the country and the effect of hunger and malnutrition on the health of the population. No attempts have been made to relate nutrient deficiencies to the methods by which the staple foodcrops are produced. Studies of the ecology of rural African nutrition have shown, however, that food intakes depend largely on what can be grown on the farms, the level and pattern of farming being dependent on environmental factors such as the landform and soil, and socioeconomic pressures.

The objective of the research summarized here was to examine land-use patterns, farming techniques, and dietary habits of farming households in Manga Bawku, a village in northeastern Ghana, and to determine the extent to which food requirements were satisfied by home production.

The survey was carried out between July and December 1969. First, household data collected by means of a questionnaire included the number of males, females, and children making up each of 36 compound units. Data on members of compound units who had migrated from the village were gathered. Information on the techniques of farming and dietary habits were also obtained by this means. Second, a land-use map was prepared with a chain and prismatic compass. In connection with this, farmers were interviewed to find out the cropping sequence on their fields. The output of crops from the fields was calculated by using yields per acre of millet and guinea corn obtained from the 1970 Ghana Sample Census of Agriculture. The number of calories and amount of protein derived from the total output of millet and guinea corn fom each production unit were then calculated using food consumption tables. Third, a detailed dietary survey was carried out in three compounds. From these data, daily per capita calorie intake was calculated.

On the basis of the data thus collected, the extent to which production units in the village could satisfy their food requirements throughout the year from their own fields was determined. Results indicated that 64% of the production units would not be able to meet their annual food requirements from their cultivated plots in the village. They would thus go hungry during certain periods of the year unless able to supplement output from their fields with purchases, with gifts from relatives, or with produce from other cultivated fields outside the village. Under prevailing land tenure arrangements in the area, a farmer can borrow land in another village to supplement home produce. Data on such produce from fields outside the village were not collected.

Although there are opportunities for supplementing the food produced in the village, the study underlines the extent to which the vacuum must be filled before the majority of production units can maintain the desirable level of calorie intake throughout the year. It is the inadequacy of these opportunities for meeting the challenge that results in hunger and malnutrition in the area, a situation that has a particularly severe effect on the nutritional status of children.

Population, Health, and Nutrition in Upper East Region, Ghana, with Special Reference to Child Health and Child Care

G. Benneh, R. Orraca-Tetteh, P.A. Twumasi, and J.S. Nabila

It has now been established that no meaningful national planning for any country can take place without a clear recognition of the interrelationships between demographic, biosocial, and economic trends. The relationships between population, health, and nutrition have therefore received attention from both social and medical scientists. Rapid population growth in Ghana continues to put a great constraint on food supply and the provision of social services in general. Food shortages in many rural areas are known to have adverse effects on the nutritional and health status of the population. Factors of family size, marital status, age structure, staple foods, education, culture, and dietary habits are all determinants of better or poor health. It was within this context of the multifaceted aspects of population and socioeconomic development that the research project was designed.

The study, which focused on the Navrongo District in the Upper East Region of Ghana, aimed to unravel the web of interrelationships among the population, health, and nutrition variables. A particular concern was to evaluate the role of intermediate variables at different levels of the individual, the household, and the community. This paper focuses on the issues concerned with field research, particularly the methods and problems of data collection in this savanna environment, with specific reference to child health and child care. It is also meant to demonstrate the benefits to be derived in the field from multidisciplinary studies on population, nutrition, and health. The research findings were therefore not to be highlighted in line with the theme of the seminar.

The major data sources were hospital statistics, censuses, household surveys (using anthropometric measurements, questionnaires, interviews, observations, and panel discussion methods). The main objective of the questionnaire administered at the household level was to determine the socioeconomic status of parents. Thus, questions concerned level of income, occupation, and education. The questionnaire also sought to define the demographic characteristics of the household. In addition, questions were asked on nutritional behaviour such as food given to children, age of weaning, breastfeeding, nutrition during pregnancy. Individual household and community variables that impinged directly on health care were obtained and analyzed. The type of water source, storage facilities, quality and quantity of water usage, how often children were washed, and how often clothes were cleaned were determined. Data also were obtained on health care use and facilities available in the community and in the district towns.

Three methods were used to assess the nutritional status of children in the area. The first involved a physical examination to detect signs of ill health. Second, anthropometric measurements were made and compared with standards. Third, data on food consumption patterns of the child were obtained through dietary recall and dietary history methods by interviewing the mother. The quality of the diet of the child in relation to desirable foods for health and growth was evaluated.

The main field problems were selecting adequate and reliable sample groups, nonresponse, inability of respondents to give reliable and valid answers, and cooperation. Respondents also tended to generalize their answers when specific answers were required.

The researchers thoroughly discussed developing an "integrative model" (a priori) before going to the field. This is a critical aspect of interdisciplinary research that must be dealt with before the actual field work takes place. It offers researchers the opportunity to determine and seek data that can readily be analyzed in a holistic manner to arrive at more meaningful and balanced results.

SUMMARY AND REFLECTIONS

Fiona Mackenzie

Given the objectives outlined in the introduction, participants were asked to prepare papers that focused on their own experiences in research on infant and child health and mortality. They were asked to reflect on conceptual and methodological problems that they had encountered or that they anticipated in proposals for future research. Thus, with the exception of the substantive papers that appear in this volume, the papers presented served to stimulate discussion around specific issues. This report will comment on four central themes that emerged during discussion of these papers: conceptual frameworks; questions of scale and of measurement; the search for indicators; and future directions for research.

Conceptual Frameworks

On the premise that no one variable is sufficient to explain high levels of infant and child mortality, Dr Sawyer, in her keynote address, observed: "the purpose of a conceptual framework is to provide a framework within which relations among variables may be studied in accordance with the relations existing in specific societies or settings." During the course of discussion, the models of Venkatacharya and Tesfay-Teklu (this volume) and Mosley and Chen (1983) provided the basis for comment.

Although both these models attempt to integrate biomedical with social science variables, and go some way in indicating how the models may be used in research practice, it was evident during discussion that difficulties remain. First, a clear definition of intermediate or proximate variables is lacking. Thus, whereas birthweight and maternal nutrition during pregnancy are significant, relatively uncomplicated variables, and useful where available, the role of other variables, such as maternal education, is more complex to assess and the nature of impact requires further investigation. Second, although existent frameworks have begun to identify process and, through this, the connections between socioeconomic variables and health indicators, the former remain relatively neglected. As a result, the question may be raised as to how far the processes identified in the models touch on the fundamental determining relations in society.

Gregory and Piché's (1986) commend Mosley and Chen's framework for its efforts at combining social science and medical approaches in the study of survival and mortality. However, they are critical, at the broad theoretical level, of its explanatory potential because their analysis of mortality is not informed by a political economy perspective addressing questions of how mortality is related to processes of social reproduction. Mosley and Chen's study isolates infant and child mortality from other demographic parameters. Gregory and Piché (1986, p. 46) argue: "la dynamique entre la santé et la population est présentée d'une façon très étroite, produisant une tendance à raisonner seulement en termes d mortalité et de survie." Gregory and Piché propose a model that tries to conceptualize relations among mortality, health, and development in Africa in the context of state policy, the structure of social classes, and global processes of social reproduction.

During discussion, as a further criticism of Mosley and Chen's framework, the unidirectional nature of the arrows was questioned, particularly with reference to the role of "institutions" and culture. The latter concept, defined by specific sets of beliefs and value systems, and evidenced through structures of kinship and of religion and ethnicity (as Dr Twumasi pointed out), was seen to be of critical importance. The lack of its adequate delineation as a variable in conceptual frameworks was identified as an area of concern in terms of developing theory that probed more deeply the specificity of African realities. Attention also focused on the lack of consideration given to ecological and environmental contexts in the development of appropriate theory.

Papers by participants and ensuing discussions identified the following areas where future theoretical developments were needed to produce a conceptual framework of more practical utility:

- the relationship between socioeconomic level and infant and child health and mortality (Barros, Victora, and Vaughan; Feysetan; Yumkella). For example, Feyisetan draws attention, in his paper, to evidence that the hypothesized linkage between maternal education and child survival is mediated by the socioeconomic status and the nature of employment of the mother. Barros et al., in the context of urban Pelotas, Brazil, argued that socioeconomic factors were important variables in analyzing the relationship between the population (and maternal and child health) and the medical profession. Their evidence indicates that a far higher proportion of Caesarian sections are performed on women belonging to higher income groups, and that birthweight and the prevalence of breastfeeding varies significantly according to income group;

- how the above relationship interfaces with culture (Twumasi; Appiah; Ubomba-Jaswa; Kandeh). Appiah, for example, is particularly concerned to link methodological issues at the level of field research with a more comprehensive understanding of cultural factors in research design. To achieve accuracy in data collection, she argues, methodology must be grounded in a culturally specific knowledge base;

- a more accurate determination of ecological/environmental influences (Iyun; Barros, Victora, Vaughan). Iyun's paper stresses the need for research that not only differentiates between ecological zones in terms of environmental influence on infant and child mortality, but that includes the environment more explicitly in explanations of mortality. The paper by Barros et al. addresses questions of the environment in the urban milieu;

- how gender stratification varies according to socioeconomic factors and culture, and the relationship of this variation with infant and child health and mortality. Although none of the papers attempted to tie men-women power relations to socioeconomic and cultural variables vis-à-vis mortality differentials, questions of gender relations were brought forward during discussions as needing further investigation in this context. For example, discussion around the paper by Benneh, Orraca-Tetteh, Twumasi, and Nabila, which focused on the relationship between health and nutrition, illustrated the need for an analysis of intrahousehold decision-making, concerning, for example, the distribution of food - whether between women and men or between the generations.

Questions of Scale and Measurement

From participants' papers as well as discussion, widespread dissatisfaction with reliance on large-scale survey methods used in isolation to probe questions of infant and child health became apparent. Although these were considered essential for generalization, it was acknowledged that going deeper was necessary to understand the complex relationships involved in research in this area. For example, Dr Kandeh observed in his paper that, with respect to the use of a household questionnaire, it was difficult to record opinions and that this was not an appropriate method by which to gauge perception. The technique of participant observation was put forward as an alternative technique, but its time requirements and restriction in terms of number of cases made it of questionable widespread usefulness. A combination of methods, often linking macro and micro approaches, was suggested. These included Dr Kandeh's "quasi-anthropological" approach of in-depth interviews with selected key members of the study population; the "case control" approach of Barros, Victora, and Vaughan; and the use of oral history techniques that allow for the open-ended and relatively unstructured collection of data. The last is an extremely useful technique if intrahousehold relationships are to be probed (Stubbs 1984).

These alternative techniques were viewed as particularly appropriate for identifying the significance of variables at the intrahousehold level. This came to the fore, for example, during discussions on the significance of a woman's education as a variable conditioning levels of infant mortality. Caldwell's (1979) observation that an educated woman has social prestige and is able to exercise greater autonomy and authority within the family, was probed. The issue was identified as a complex one in the discussion surrounding Dr Feyisetan's paper. In the context of research carried out in Ile-Ife, Nigeria, Dr Feyisetan had observed that infants of mothers with secondary education had higher mortality risks than infants of mothers with primary education. He argued that in Ife, the negative impact of secondary education was related to the nature or the location of work. Specifically, this concerned the question of how a woman was able to ensure a "fit" between her "productive" and "reproductive" responsibilities, and who cared for the child for much of the time. The role of a maidservant was examined in this context. Attention was also drawn to the fact that in examining a variable such as maternal education, social prestige, which is interrelated with factors other than education, needs to be distinguished from control over resources.

At a more general level with respect to measurement, Dr Mbacké's paper addressed some of the problems associated with estimating procedures identified in the keynote address by Dr Sawyer. Specifically, he proposed a new approach for mortality estimation, grouping mothers by parity instead of by age for conditional samples and tested this using Enquête mortalité infantile dans le Sahel (EMIS) multiround data. Concerns as to the expense of such surveys were the focus of discussion.

The Search for Indicators

Critical issues in this area, for example with respect to maternal education as a variable influencing infant and child health and mortality, have already been identified. But this area proved to be one of the most elusive to come to terms with during the workshop. The following additional examples will give some indication of the breadth of concern. The majority had to do with the role of culture, but as was observed, it is frequently difficult to isolate cultural from economic factors. The main areas debated included the following:

- Definitions of disease. It was noted, for instance, that during collection of data some diseases may be downplayed or ignored because action cannot be taken on them, partly because health service is inaccessible which, in turn, is related to economic factors. The lack of recognition of diarrhea as a disease was cited in this context.
- Information on births and pregnancies. Withholding data on reproductive histories was examined in some detail and was considered due to a complex set of factors. For example, Ms Appiah drew attention to the fact that mothers in specific cultures are frequently told to forget infant deaths in an effort to overcome the loss. She suggested a series of questions that can help to get around this problem, for example, by identifying gaps in sequence in cultures where each child is named according to a specific order. The need for culturally acceptable questions was discussed extensively with reference to this.
- Level of education. In addition to the issues discussed earlier, the problem of equating level of education with years of schooling was raised.
- Water supply as an indicator. Although a piped water supply is often positively associated with child health, use of this variable may be misleading. Irregularity of supply in quantity or quality may lead to an increase in morbidity, according to evidence presented by Dr Feyisetan.
- Measurement of current socioeconomic status and extrapolation from this to explain past data on infant and child mortality.

The need to go beyond conventional variables such as education and income to find culturally contextual ones was a theme constantly reiterated during the workshop. This was particularly relevant in the context of differences in the household division of labour and responsibilities, in family structure, and in child care. Although it was acknowledged that these issues were of particular concern in the

African context in general, it was recognized that they would have to be defined in culturally specific ways.

Directions for Future Research

Discussion in this area centred on the need for action-oriented or operations research and the implications of this approach for the formulation and implementation of policy. A key concept that emerged from discussion was community participation. In this context, for example, Dr Gardiner spoke of the challenge of establishing intersectoral networks among the community, the Ministry of Health, universities, and research institutions, and of promoting the involvement of a community in the active resolution of its health problems as part of a primary health care approach. Research into three specific areas was identified by her as critical to achieve success: assessing alternative models of systems for primary health care; adapting health technology relevant to a health care strategy based on local participation; and developing appropriate health status indicators to evaluate the impact of primary health care services.

In addition to expanding on the need for research in these three areas, and emphasizing the need to develop appropriate technologies such as heat-stable vaccines, Dr Caillaux's observations on action-oriented research focused on the partial cost recovery of health programs, the development of readily implementable training programs, research on what he defined as "leading edges," such as the local issues involved in the success or failure of oral rehydration therapy, and the identification of local communication channels for dissemination of information.

In the context of proposals for research into health information systems and alternatives to collecting vital events registration, Dr Ashitey outlined his work in assessing the impact of primary health care in the Suhum/Kraboa Coaltar District of Ghana. Here, three groups of people - the health team, the vital event recording assistant, and the general public - are involved in collecting data, the responsibility for obtaining data resting on those who need the information to carry out an effective program. Participation of the local community in data collection may be a particularly suitable approach in Africa where the population is primarily rural and where local "informed" networks of communication are strong.

Community participation was seen as significant not only with reference to the delivery of health care systems and the collection of data, but also in terms of problem definition and modes of solution. The inappropriateness of "top-down" models of organization of health services, the necessity for effective devolution of power rather than the delegation of responsibility, and the need for operational research models that would assist in developing "synergistic programs" thereby obviating the requirement for vertical programing were proposed in this context by Dr Orraca-Tetteh.

A final key to the effective development of appropriate programing on which discussion centred was the challenge of multidisiplinary research. Being more than a sum of the constituent parts, such research begins, as Dr Sawyer noted in the keynote address, at the level of the conceptual framework. From the contribution of participants to the workshop, it is evident that research is moving in this direction. Disciplinary boundaries are becoming permeable and existing concepts are being questioned as new definitions are sought. Increasingly, flexibility rather than rigidity is informing methodological choice, researchers frequently indicating that they are concerned to probe beyond statistical data bases to understand structures and processes that impinge on infant and child mortality and morbidity. It is hoped that strengthening the research networks that support these new intiatives will lead to development of research more appropriate, than previously was the case, to Africa.

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